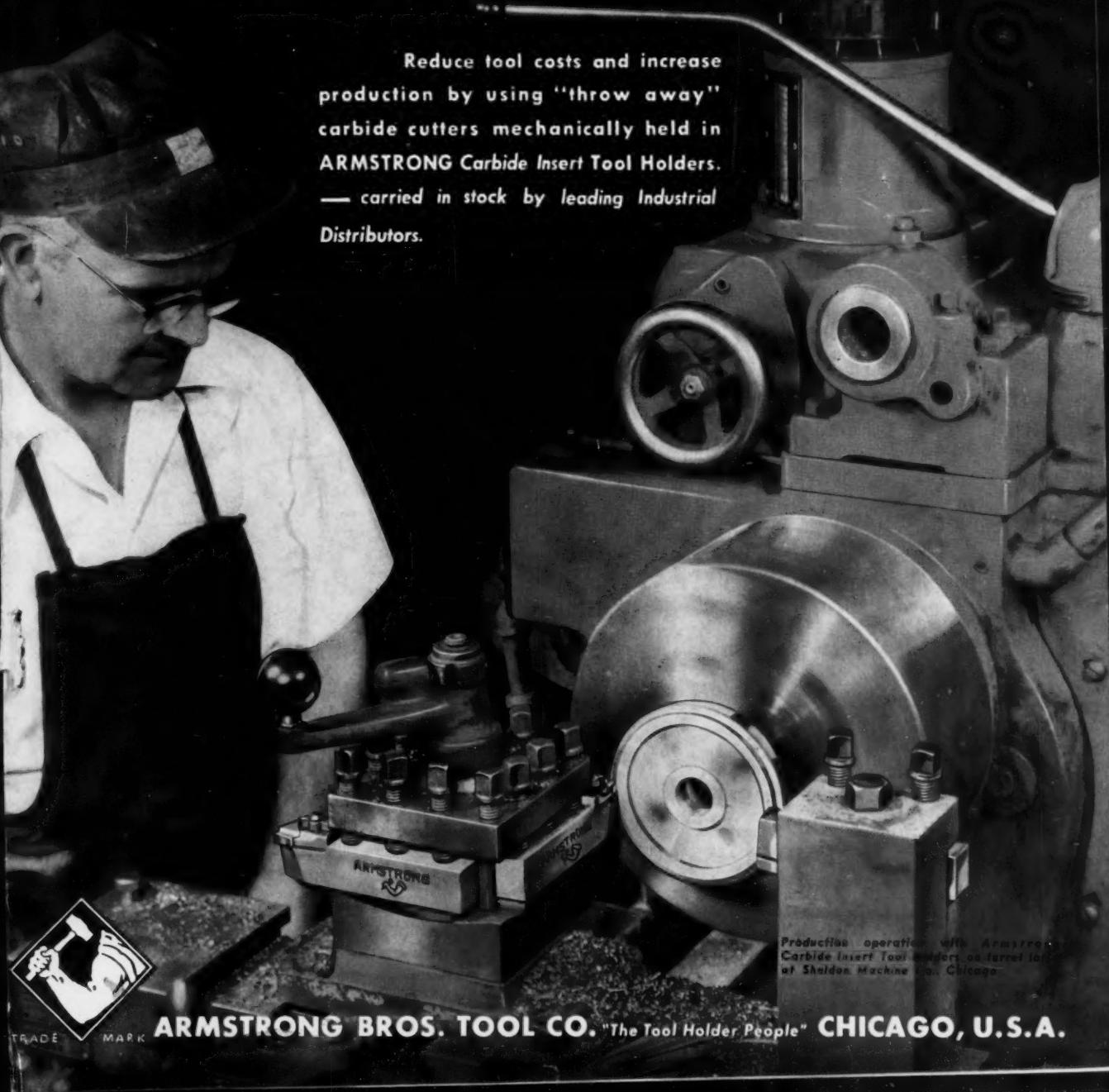


JANUARY 1957—SIXTY-THIRD YEAR

# MACHINERY

## ARMSTRONG *Carbide Insert* TOOL HOLDERS

Reduce tool costs and increase production by using "throw away" carbide cutters mechanically held in ARMSTRONG Carbide Insert Tool Holders. — carried in stock by leading Industrial Distributors.



Production operation with Armstrong Carbide Insert Tool Holders on turret lathe at Sheldon Machine Co., Chicago.

**ARMSTRONG BROS. TOOL CO. "The Tool Holder People" CHICAGO, U.S.A.**

**Heald RED HEAD'S extra precision and low maintenance**

# **NOW AVAILABLE TO ALL USERS**

**of boring and internal grinding equipment**

**H**EALD Red Head Boringheads and Wheelheads have achieved an enviable reputation for extreme precision and exceptionally low maintenance, on Heald Bore-Matics and Internal Grinders in use throughout the entire metalworking industry. Heretofore, they have been available only as original equipment or replacement items for specific Heald machines.

Now, however, in response to a continual and ever-increasing demand — and in line with the Heald policy of building standard machines and parts — it

has been decided to market all standard Red Head Boringheads and Wheelheads without restriction wherever practical. This means that the extra precision and low maintenance provided by Heald Red Heads are now available to all users or manufacturers of metalworking equipment, regardless, in most cases, of the type of machines on which they will be used.

The standard head types and sizes that can be supplied are fully described and listed in the Bulletins noted below.



#### **HEALD PERMANENTLY- LUBRICATED BORINGHEADS**

Designed to provide high, sustained precision with virtually no maintenance, Heald Red Head Boringheads are permanently lubricated — no grease or oil is ever needed. They run cooler, reduce heat distortion and maintain high accuracy at all speeds and loads. Spindles run in precision bearings, specially manufactured to Heald specification and individually tested and selected for each head. Write for Bulletin 5-1, Issue 6.

#### **HEALD HI-FREQUENCY WHEELHEADS**

Providing proper speed for small-bore grinding, Heald Hi-Frequency Wheelheads deliver full power direct to wheel and eliminate drive upkeep costs. They can withstand momentary peaks of twice the continuous-duty rating. Those running over 30,000 rpm must be automatically lubricated by the Heald Oil-Mist system which also supplements effects of water cooling — others are permanently grease lubricated. Write for Bulletin 6-2, Issue 2.

#### **HEALD PERMANENTLY- LUBRICATED WHEELHEADS**

Heald Red Head Wheelheads incorporate the same high quality bearings and permanent, sealed-in lubrication as Heald Red Head Boringheads. They have repeatedly set the highest standards of accuracy, precision and surface finish. There are three general types: Quill Style, for a variety of work — Naked Style for high production on a single workpiece — Sleeve Style for large bores. Write for Bulletin 6-1, Issue 7.

***IT PAYS TO COME TO HEALD***

#### **THE HEALD MACHINE COMPANY**

Subsidiary of The Cincinnati Milling Machine Co.

**Worcester 6, Massachusetts**

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

**MACHINERY**  
 Editorial, Advertising, and  
 Circulation Offices  
 93 Worth St., New York 13, N. Y.  
 CANel 6-8120

Editor  
**CHARLES O. HERB**

Managing Editor  
**CHARLES H. WICK**

Associate Editors  
**FREEMAN C. DUSTON**  
**EDGAR ALTHOLZ**  
**RAYMOND H. SPIOTTA**

Assistant Editor  
**HAROLD W. BREDIN**

Materials Editor  
**PAUL B. SCHUBERT**

Shop Mathematics Editor  
**HENRY H. RYFFEL**

**THE INDUSTRIAL PRESS**  
 Publishers  
**ROBERT B. LUCHARS**  
 President  
**EDGAR A. BECKER**  
 Vice-President and Treasurer  
**HAROLD L. GRAY**  
 Secretary and Publishing Manager

Advertising Representatives  
**WALTER E. ROBINSON**  
 DWIGHT COOK  
 93 Worth St., New York 13, N. Y.  
**GEORGE H. BUEHLER**  
 228 N. LaSalle St., Chicago 1, Ill.  
**NORMAN O. WYNKOOP, Jr.**  
 15937 W. Seven Mile Road  
 Detroit 35, Mich.  
**DON HARWAY & COMPANY**  
 1709 W. Eighth St.  
 Los Angeles 17, Calif.  
**RICHARD E. HOIERMAN**  
 2831 El Capitan St., Dallas 28, Tex.  
**FRED W. SMITH**  
 1212-41st St.  
 Belview Heights, Birmingham, Ala.

MACHINERY, published monthly by  
 The Industrial Press, Emmett St., Bris-  
 tol, Conn. Executive offices, 93 Worth  
 St., New York 13, N.Y.

Subscription rates: United States and  
 Canada, one year, \$4; two years, \$7;  
 three years, \$8; foreign countries, one  
 year \$7; two years, \$13. Single copies,  
 50 cents. Changes in address must be  
 received by the tenth of the month  
 to be effective for the next issue. Send  
 old as well as new address. Copyright  
 1956 by The Industrial Press.

Entered as second-class mail matter  
 May 25, 1953, at the Post Office at  
 Bristol, Conn., under the Act of March  
 3, 1879. Printed by Hildreth Press, Inc.,  
 Bristol, Conn., U.S.A.

British Address  
**MACHINERY**  
 National House, West St.  
 Brighton 1, England

French Address  
**LA MACHINE MODERNE**  
 15, Rue Bleue  
 Paris-IX<sup>e</sup>, France



# MACHINERY

VOLUME 63 JANUARY, 1957 NUMBER 5

The Monthly Magazine of Engineering and Production  
 In the Manufacture of Metal Products

## SHOP PRACTICE

|   |  |     |
|---|--|-----|
| Fuel Injectors Call for Microscopic Methods ..      | By John Hedges                                   | 127 |
| Unusual Setups on Automatic Turret Lathes ..        | By D. L. Hansen                                  | 132 |
| "Mastering" Master Gears .....                      | By Martin A. Hartman                             | 134 |
| Wet-Belt Grinding Finishes Variable-Pitch Pulleys   | By William E. Hoppock                            | 141 |
| Intricate Plastic Parts Formed by Precision Molding | By Francis DeBartolo                             | 143 |
| Machine Bases Tailor-Made to Meet Special Needs     | By P. E. Butzin                                  | 145 |
| Thin-Wall Groove Cut with Special Tooling .....     | Multiple Clamps Insure Accurate Heliaire Welding | 147 |
| Ultrafinishing—A New High-Precision Lapping Process | By George Broslaski and Wells McGregor           | 148 |
|   | By T. G. Lewis, Jr.                              | 152 |

## MACHINE AND TOOL DESIGN

|   |  |     |
|---|--|-----|
| Compound-Angle Setups Made Easy by Unique Three-Ball Sine Plate .....                     | By James R. Hansen   | 160 |
| How Are YOUR Carbide Tools Performing? .....  | 165  |     |
| Ceramic Tooling Tests at Kearney & Trecker  | By A. O. Schmidt, W. I. Phillips, C. F. Wilson, and I. Ham | 175 |
| Forming Ball Bearing Races on a Lathe .....   | By Donald Baker  | 182 |
| Work-Rest for Surface Grinding Parts Seated on Angular Face                               | By J. Randolph Lucas                                       | 183 |
| Cam-Operated Chuck Featuring Self-Adjustment .....  | 184  |     |
| Mechanism That Imparts Variable and Unequal Strokes to Opposed Reciprocating Slides ..... | By W. M. Halliday  | 185 |
| Crank-Driven Plate Obtains Near-Uniform Velocities Through Compensating Cam .....         | By W. M. Foster  | 187 |
| American Standard—Nuts (Data Sheet) .....   | 215  |     |

## MANAGEMENT PROBLEMS

|  |                    |     |
|--|--------------------|-----|
| The Year Ahead .....                   | By Charles O. Herb | 125 |
| Organization Charts Are a Puzzle ..... | By Bernard Lester  | 159 |

## DEPARTMENTS

|                              |     |                              |     |
|------------------------------|-----|------------------------------|-----|
| Keeping Up with Washington   | 123 | Ingenious Mechanisms .....   | 185 |
| Talking with Sales Managers  | 159 | The Latest in Shop Equipment | 188 |
| In Shops Around the Country  | 162 | Data Sheet .....             | 215 |
| Problem Clinic .....         | 164 | Between Grinds .....         | 224 |
| Reference Section .....      | 165 | News of the Industry .....   | 226 |
| Materials of Industry .....  | 173 | New Catalogues .....         | 233 |
| Tool Engineering Ideas ..... | 182 | Coming Events .....          | 243 |
| Book Reviews .....           | 243 |                              |     |

## Product Directory

246

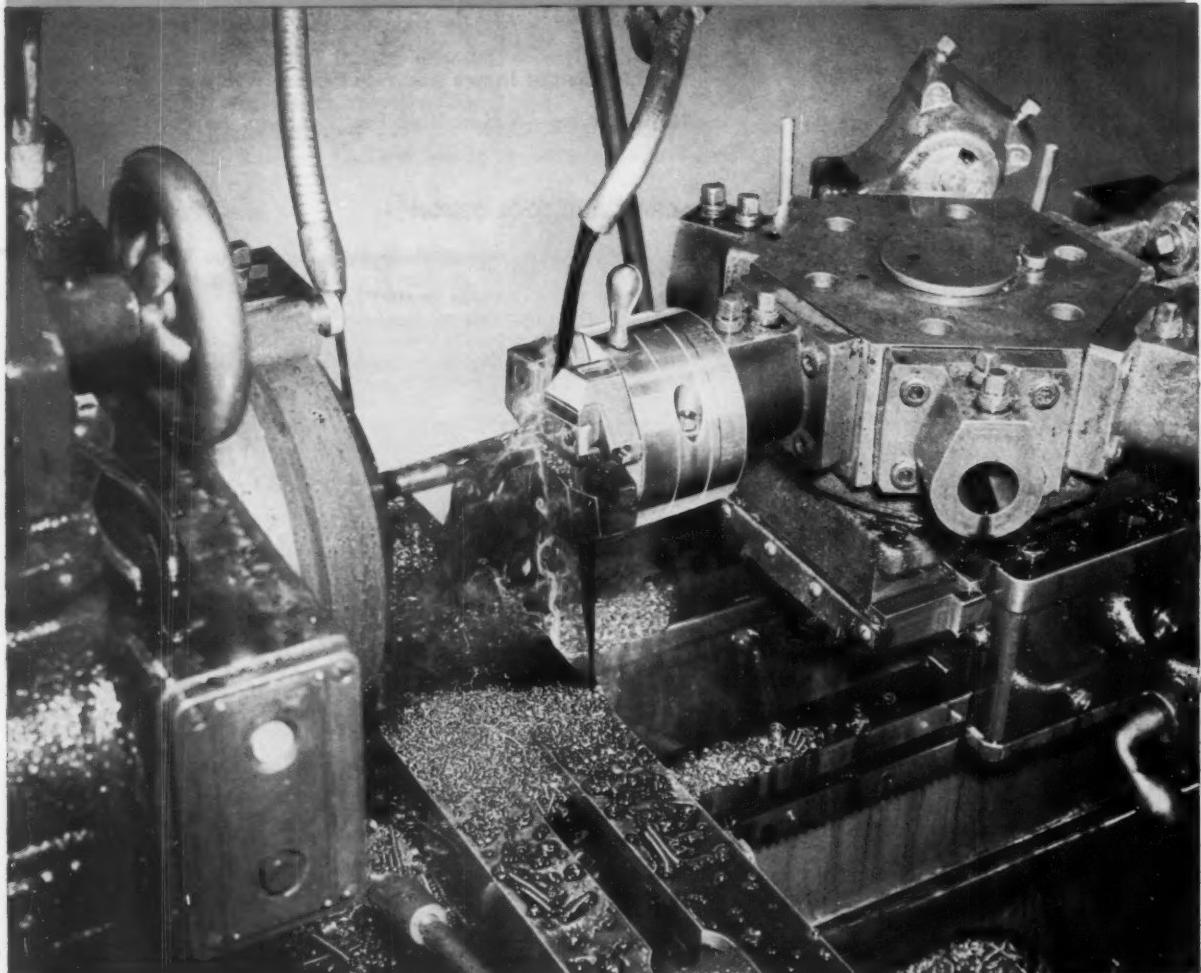


## Advertisers Index

331-332

# LANDMATIC

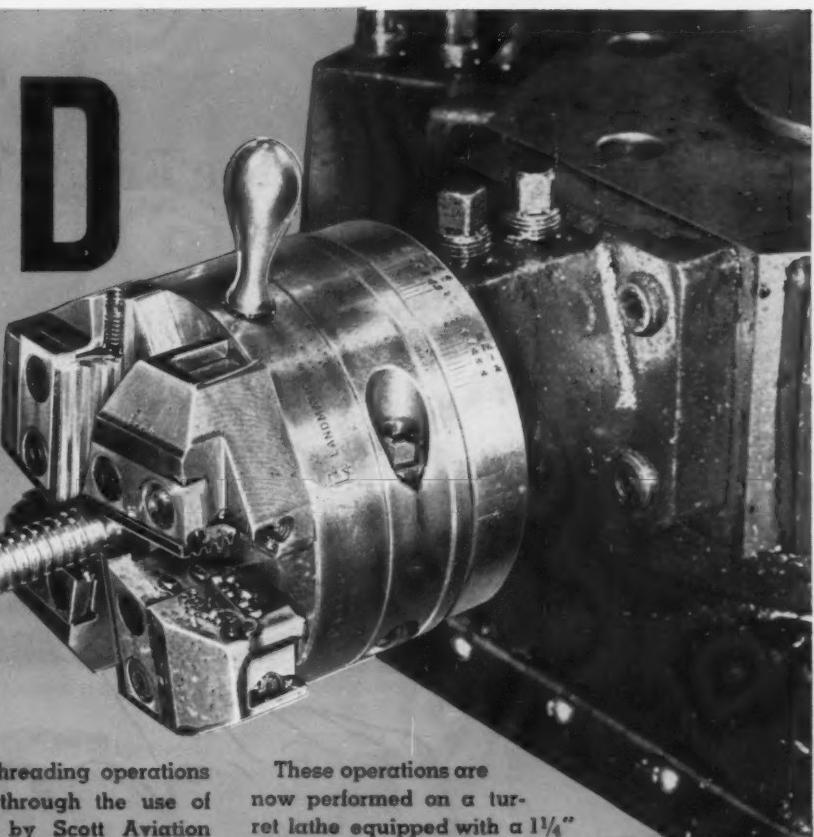
## *Reduces Cost by*



• • • • THE WORLD'S LARGEST EXCLUSIVE

# HEAD

# 75%



Large savings on threading operations have been realized through the use of LANDMATIC Heads by Scott Aviation Corporation, an aircraft equipment manufacturer. These savings are made possible by great reductions in machining time and by quicker product assembly resulting from improved thread quality.

In producing Stabilizer Screws for a light aircraft manufacturer, a  $\frac{3}{8}$ -6 Acme thread must be cut to a length of  $5\frac{1}{2}$ " on cold-drawn stock, Spec. #AISI, B1112. This thread must be held to the close tolerance of  $\pm .001$  between the P.D. of the thread and the O.D. of the screw, for the full thread length.

Former threading methods required two passes to produce the finished thread to the required tolerances—one roughing and one finishing cut. Even then, hand fitting with the mating nut was necessary during assembly.

These operations are now performed on a turret lathe equipped with a  $1\frac{1}{4}$ " LANDMATIC Head and a Lead Screw Attachment. The required thread is cut in one pass in .192 minutes using a spindle speed of 230 RPM. Recent correspondence shows that approximately 3,500 pieces are completed between regrinding of the chasers. The general manager states that "We are quite proud of the fact that this job has worked out as well as it has and it is still running very efficiently."

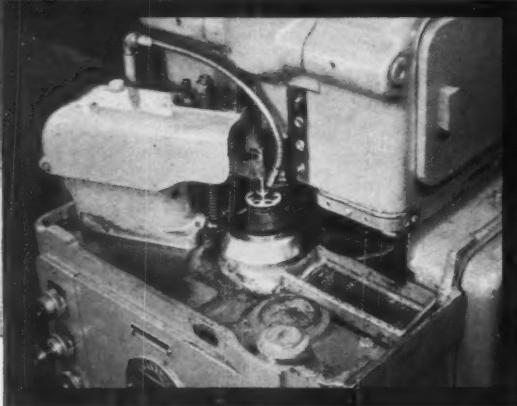
LANDMATIC Heads are stationary self-opening threading heads designed for use on turret lathes. Their unusually-large oversize capacity allows them to handle a wide variety of threading operations. For further information and specifications, write for illustrated Bulletins F-80 and F-90.

**LANDIS** *Machine company*  
WAYNESBORO • PENNSYLVANIA • U. S. A.

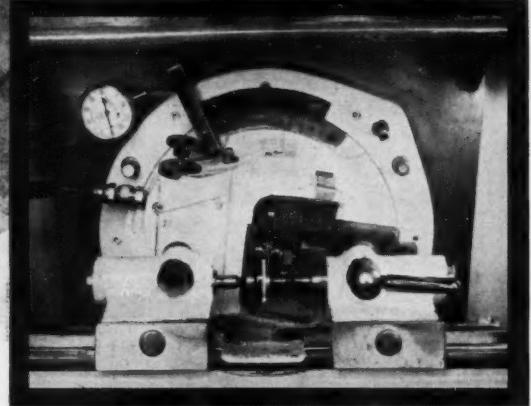
MANUFACTURERS OF THREAD GENERATING EQUIPMENT



## "Putting the Finger" on supersonic demands

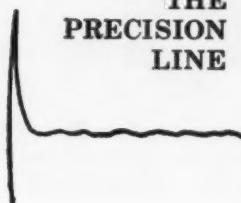


Fellows 3" Fine Pitch Gear Shaper cutting precision spur gears at Hughes Aircraft. Cutter speeds as high as 2000 strokes per minute are used.



Fellows No. 4 Fine-Pitch Gear Shaver finishes Hughes gears to tolerances as close as 0.0003" tooth-to-tooth composite error, 0.0005" total composite error.

THE  
PRECISION  
LINE



targets

## PRECISION GEARS...



**M**odern military aircraft travel 0.2 or more miles per second, missiles even faster! Control systems for detection and interception at such speeds must meet unprecedented demands for accuracy.

For their advanced armament control systems—the “electronic brains” of all types of Air Force interceptor airplanes, both American and Canadian, now guarding the North American contin-

uent from attack—as well as for use in the Falcon air-to-air guided missile, Hughes Aircraft Company manufactures up to 15,000 precision fine pitch gears per month. Tolerances are as close as 0.0005" total composite error, tooth-to-tooth composite error not in excess of 0.0003". Yet standard Fellows Gear Production and Inspection Equipment does the job.

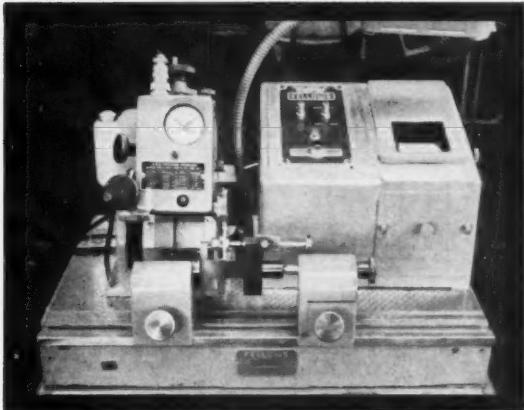
In use at Hughes are Fellows 3" Fine Pitch Gear Shapers and Fellows No. 4 Gear Shavers for production. Inspection instruments are Fellows No. 4 Fine-Pitch Red Liner instruments and No. 12M Involute Measuring instruments.

To combine extreme accuracy with high production rates, look to the complete line of Fellows gear production equipment. Write, wire, or phone your Fellows Representative at any Fellows Office.

**THE FELLOWS GEAR SHAPER COMPANY**  
78 River Street, Springfield, Vermont

Branch Offices:

1048 N. Woodward Ave., Royal Oak, Mich.  
5835 West North Avenue, Chicago 39  
150 West Pleasant Avenue, Maywood, N. J.  
6214 West Manchester Ave., Los Angeles 45



Fellows No. 4 Fine Pitch Red Liner records tooth-to-tooth and total composite errors on permanent graph for Hughes production control.

**Fellows** Gear Production Equipment

# Cincinnati Combines Quality Control and *for Your Precision Centertype Grinding*

Every shop wants closer control of quality and production. It's especially desirable for final operations, when cost per unit nears its maximum. In the field of precision centertype grinding on 6" to 14" machines, CINCINNATI'S® standard and extra features combine quality control and production control into a unified, automatic function of the machine. You will be interested in knowing why:

No adjustment of grinding wheel spindle bearings required for any job setup. FILMATIC bearings are self-adjusting.

Grinding wheel is automatically balanced in a few seconds, on the machine, at operating speed.

\*Automatic Air-Electric Gage Sizing incorporates cycle time stabilizer. As the wheel wears, original length of cycle is automatically maintained.

The non-productive time spent in "cutting air," occasioned by variations in grinding stock, is greatly reduced by the \*Gap Eliminator feature. The actual grinding rate starts only when the wheel contacts the work.

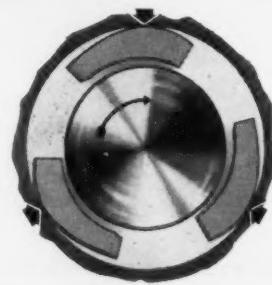
The above cost-control features and many others are outlined in two attractive catalogs: No. G-660-1 for the CINCINNATI FILMATIC 6"R and 10"L Plain Hydraulic Grinding Machines. No. G-661 for the 10"R and 14"L Machines. Write for copies, or look in Sweet's for brief specifications.

\*Extra Cost

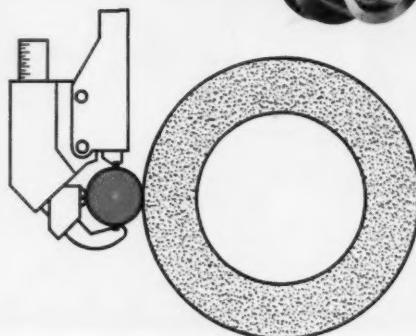
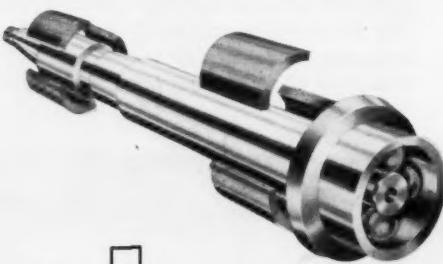
**CINCINNATI GRINDERS INCORPORATED**  
**CINCINNATI 9, OHIO**



# CINCINNATI

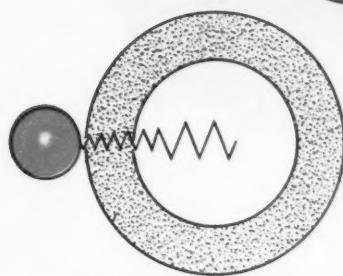


FILMATIC Grinding Wheel Spindle Bearings and Grinding Wheel Balancing are standard equipment. (FILMATIC principle illustrated above.) These two cost-reducing features alone are reason enough to choose CINCINNATI.



Automatic Air-Electric Gage Sizing (extra) includes an exclusive CINCINNATI advantage . . . cycle time stabilizer for wheel wear and truing.

# Production Control



**Gap eliminator . . .** greatly reduces time spent in "cutting air" during automatic in-feed grinding operations. (extra)

Members of this family group of  
CINCINNATI® FILMATIC Plain Hydraulic Grinders are:

| Size           | Between-Center Lengths       | Catalog |
|----------------|------------------------------|---------|
| 6" R<br>10" L  | 18" and 30"                  | G-660-1 |
| 10" R<br>14" L | 18", 36", 48"<br>72" and 96" | G-661   |

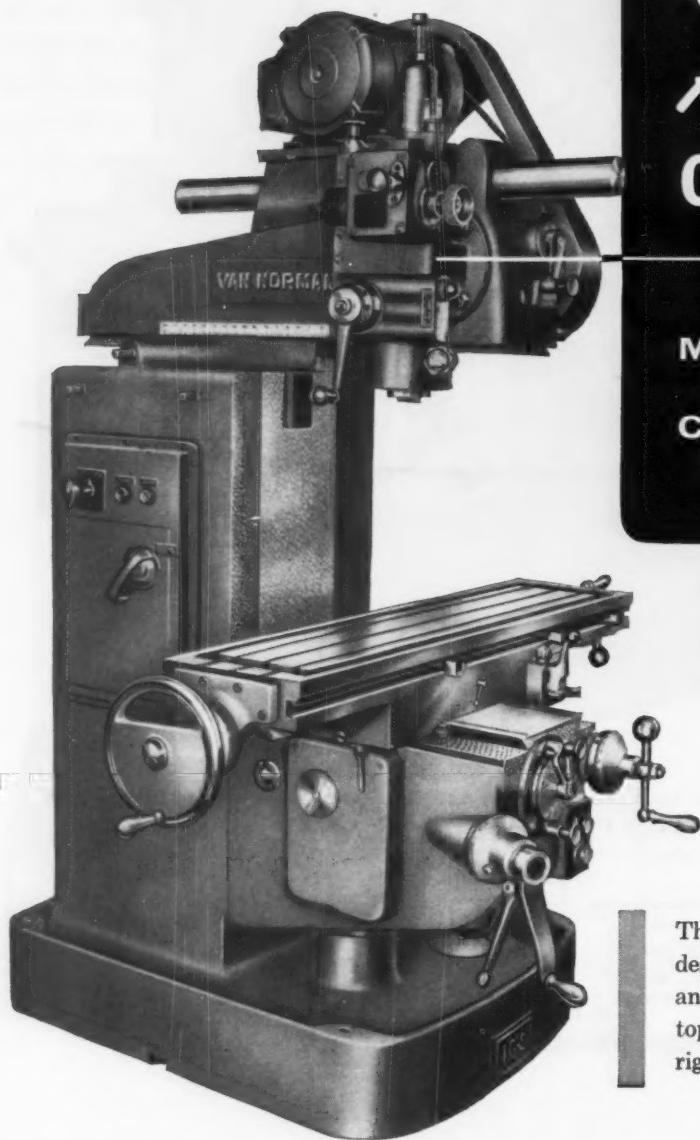
**CINCINNATI FILMATIC**  
**6" R x 18"**  
**Plain Hydraulic Grinding Machine**  
Equipped with Quality Control  
and Production Control

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPING MACHINES

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—7

# The VAN NORMAN



WITH THE  
**QUILL-TYPE**  
*Adjustable*  
**CUTTERHEAD**

Gives you  
**MORE VERSATILITY**  
**PLUS MORE**  
Cutability than Single  
Purpose Machines

**No. 165**  
Quill Travel: 4"  
Quill Power Feed: .0015; .003; .006  
22" Power feed to table  
Cutterhead Spindle Motor: 2 HP

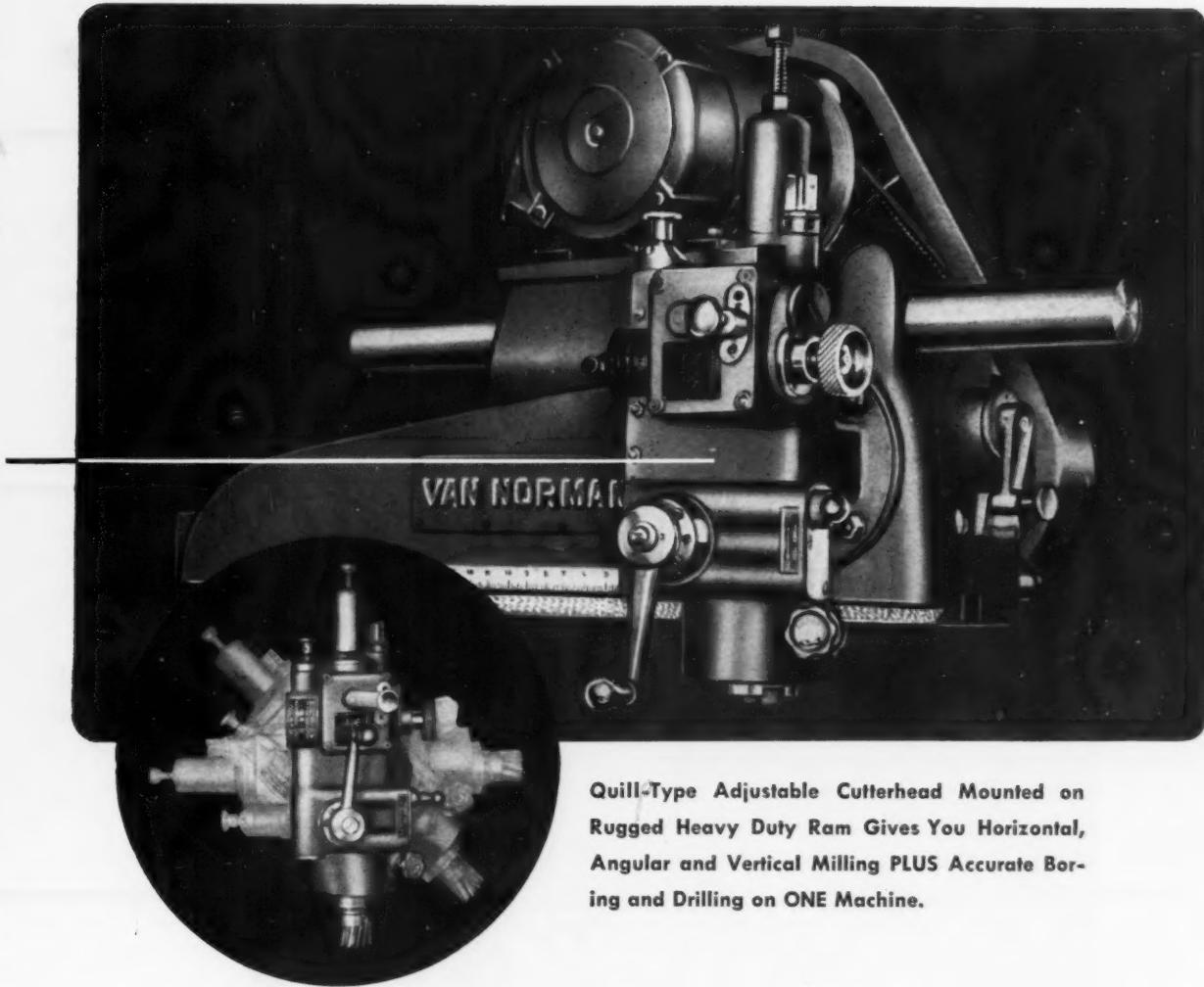
You can own this machine for as  
little as \$4.98 per day

This new Van Norman Ram Type Miller is designed to increase your milling production and reduce milling costs. Entirely new from top to bottom, it is engineered for maximum rigidity, cutability and accuracy.

## VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

# No. 16S Ram Type Miller



Quill-Type Adjustable Cutterhead Mounted on  
Rugged Heavy Duty Ram Gives You Horizontal,  
Angular and Vertical Milling PLUS Accurate Bor-  
ing and Drilling on ONE Machine.

A single investment in this one miller gives you the equivalent of two single purpose machines plus attachments at the much lower cost of a single machine. It is available in both plain and universal models. *Write for complete details today.*

Don't wait . . . for extra profits install a Van Norman now! They are available on many purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . up to 10 years. See your dealer or write Van Norman Machine Company.

Lease and Conditional Sales Contracts not available to Export.

*Write for complete details today.*

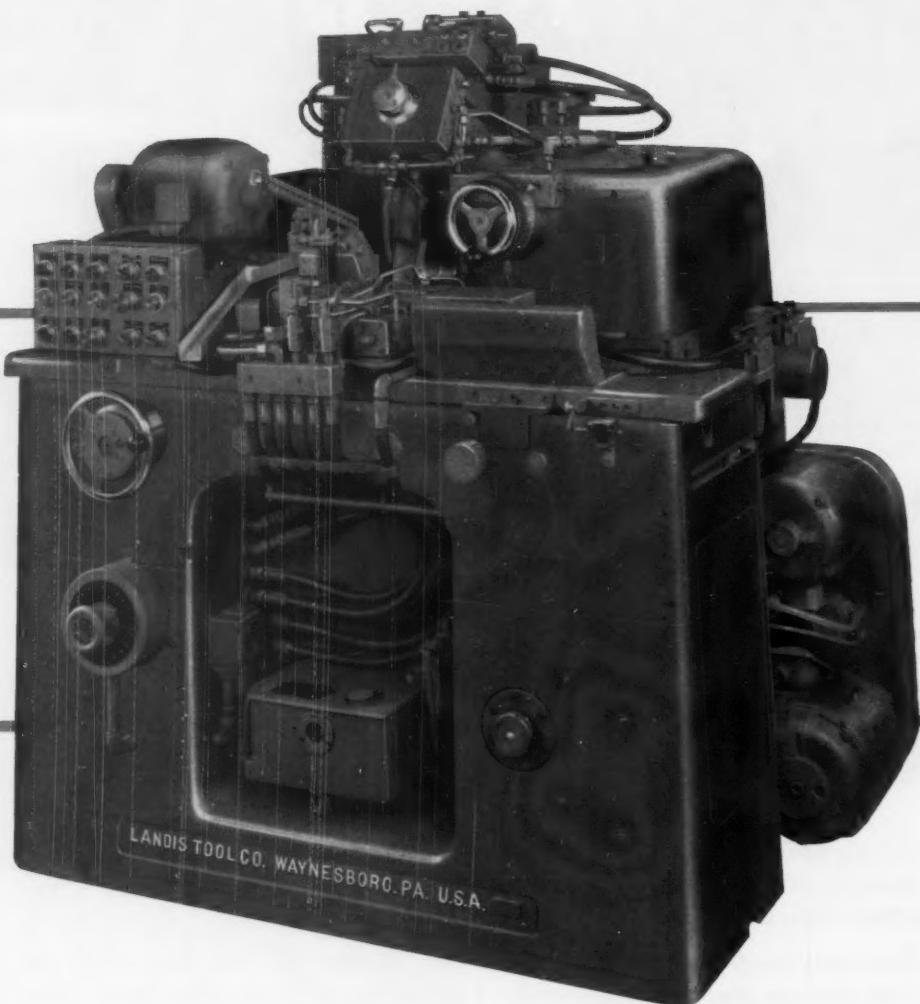
**COMPANY**

**SPRINGFIELD 7,  
MASSACHUSETTS**

# Change automatic grinder

*... grinding small parts by the shoe-type*

---



Landis 4" Automatic Concentric Grinder  
arranged for grinding grooves in inner races

---

**LANDIS**  
precision grinders

# setup in less than one hour!

**centerless method on Landis 4" concentric**

shoes locate on I.D.  
work loaded automatically



actual time recorded during a typical major setup change

|  |                 |
|--|-----------------|
| 1 Remove guard, magazine, guide cover and plate . . . . .  | 31 Sec.         |
| 2 Remove work arbor and chuck . . . . .                    | 2 Min. 10 Sec.  |
| 3 Install new driving chuck (or driver) . . . . .          | 2 Min. 15 Sec.  |
| 4 Install work setting gauge, adjust and remove . . . . .  | 4 Min. 30 Sec.  |
| 5 Install guard, magazine, guide cover and plate . . . . . | 3 Min. 10 Sec.  |
| 6 Install lapping wheel, lap chuck and remove . . . . .    | 15 Min.         |
| 7 Locate carriage . . . . .                                | 3 Min.          |
| 8 Set diamond for correct radius and dress . . . . .       | 6 Min.          |
| 9 Adjust cycle and headstock speed . . . . .               | 4 Min.          |
| TOTAL TIME ELAPSED . . . . .                               | 40 Min. 36 Sec. |

change setup in  
less than one hour

parts like these ground  
to super precision



LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

# INCREASE PROFIT MARGIN ON FORMED STAMPINGS WITH U.S. MULTI-SLIDES®

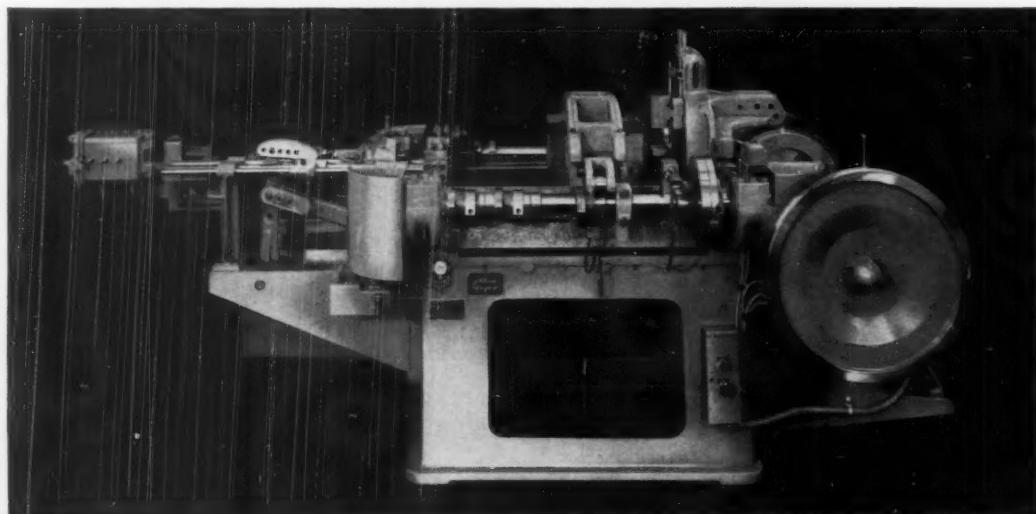
Reduce your costs and increase your profit potential! The elimination of secondary operations and handlings is one of the best ways in which you can achieve reduced costs. It is therefore important to produce parts, wherever possible, complete in one machine.

The U. S. Multi-Slide, through a combination of built-in motions, allows for the designing of tools to fabricate precision formed metal stampings without secondary handlings.

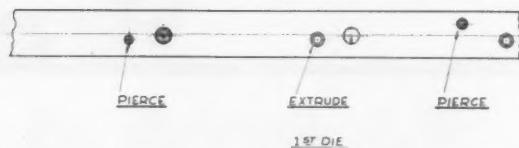
For example, the automotive component shown

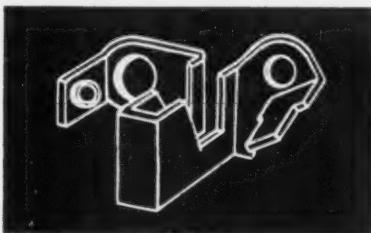
above is produced complete, without secondary operations, in the No. 33 U. S. Multi-Slide Machine of the type illustrated below. The drawings below indicate the sequence of stages in the dies and forming positions. Note the two-level forming position used to complete the piece after cutting off. This automotive part is but one of the many types of formed metal stampings which can be produced complete in the U. S. Multi-Slide.

Standard equipment on the Multi-Slide in-



Above: The No. 33 U. S. Multi-Slide used, with two rams and appropriate tooling, to produce the formed stamping illustrated on the facing page. This size machine has a capacity for material up to 2 1/2" wide by 3/32" thick, with feed length adjustable up to 12 1/2".





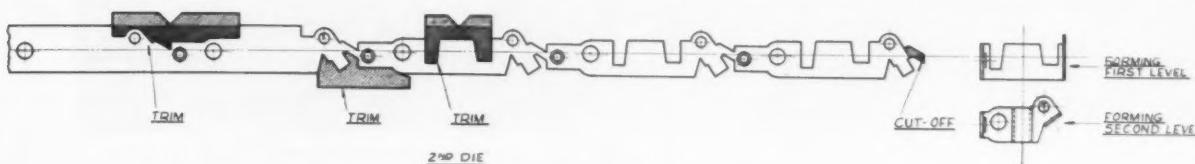
cludes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position, and a vertical movement for stripping and transferring. Since these movements are an integral part of the machine equipment, it is not necessary to incorporate complicated movements into the dies themselves. These features make the U. S. Multi-Slide extremely versatile in the automatic, high-speed production of all types of formed metal stampings.

Investigate! Ask for a copy of Bulletin 15-M, or send us part drawings or samples for our recommendations.

## U. S. TOOL COMPANY, INC.

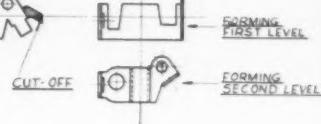
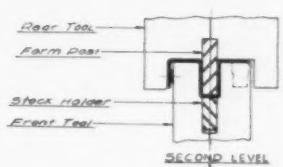
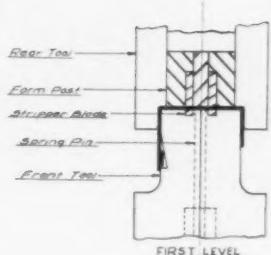
Ampere (East Orange) N. J.

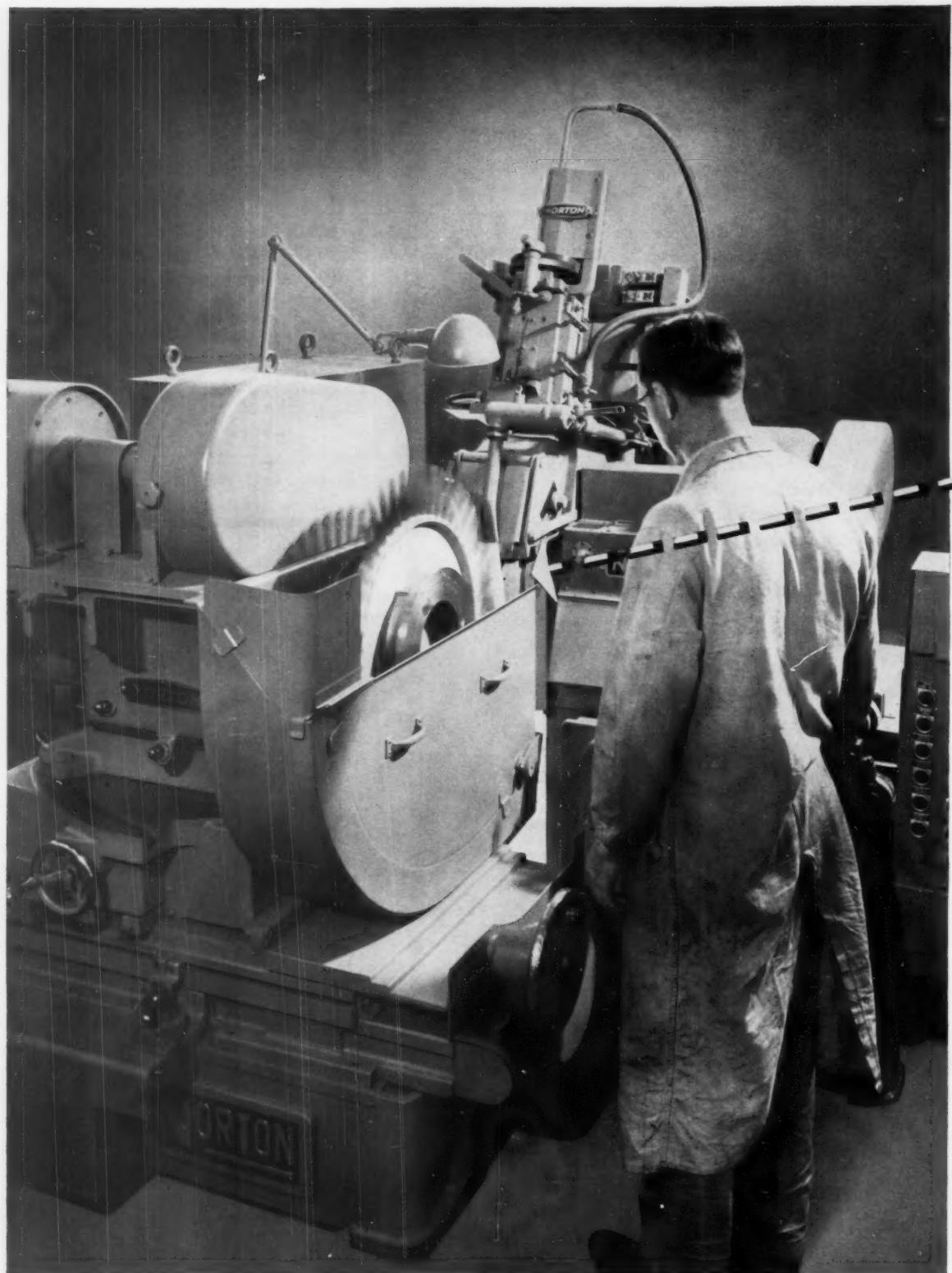
Builders of U. S. Multi-Slides—U. S. Multi-Millers—U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories.



### SEQUENCE STRIP SHOWS OPERATIONS PERFORMED

The drawing below shows the sequence of stages in the dies and forming positions of the U. S. Multi-Slide to produce the automotive component illustrated above. Observe the two-level forming position used to complete the piece after cutting off.





*Grinding Short Parts With Large Diameters*, like this compressor wheel, is a much faster and easier job on the Norton 42" Hi-Swing Semiautomatic Chucking Grinder. To the standard advantages of Norton semiautomatic design this machine adds many advanced features of its own for easier loading and unloading and faster, simplified operation. Results: less tiring work for your operators — a consistently higher production rate for you.

# Now you can grind large diameter, short parts



*The Norton 42" Hi-Swing Semiautomatic Chucking Grinder  
features speed, adaptability and easy operation*

For "Hi-Swing" in the name of the Norton 42" Hi-Swing Semiautomatic Chucking Grinder you can substitute "high speed," "high efficiency" or "high production" — and you'll be right every time!

Designed especially for rapid, accurate grinding of large diameter, short parts — such as jet engine compressor wheels and many similar components — it is particularly suited for jobs where both external and internal grinding are required. It takes work held by chucks, face plates or special fixtures and permits several surfaces to be ground without disturbing the set-up.

#### *For easy operation*

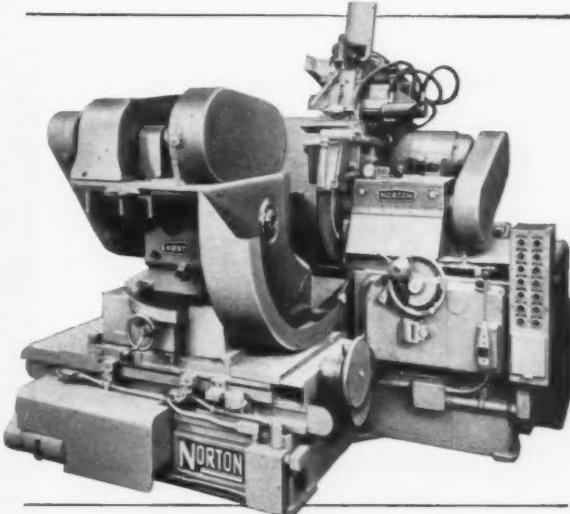
- Automatic or manual work rotation control by simple selector switch.
- Automatic or manual coolant flow control.
- Automatic feed cycle under one-lever control.
- Automatic wheel truing under push-button control.
- Excellent clearance conditions for loading and unloading.
- Maximum visibility of grinding action.
- All controls within easy reach of operator.
- Graduated wheel feed handwheel with "click-count" index.
- Power work head table traverse with automatic reverse by hydraulically operated rotating screw.

The automatic functions of the Hi-Swing Grinder combine to assure you a pre-determined, consistent rate of output. Advanced features like the wheel truing device greatly reduce the requirement of operating skill. And the careful consideration of the operator in the over-all design is still another factor that cuts down fatigue, saves time and enables continuous high production.

#### *In your own plant*

you'll find this pace-setting grinding machine a real profit-boosting production tool on many jobs that are now using up too much of your operators' time — and *your* money.

See your Norton Representative for further details on the 42" Hi-Swing Semiautomatic Chucking Grinder. Or write for Catalog. And remember: only Norton offers you such long experience on grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.



*Designed For Easy Maintenance*, the 42" Hi-Swing Grinder has all pumps, motors and filters mounted outside . . . pressure relief valves for hydraulic and ways lubrication systems conveniently placed . . . ways lubricant flow control valves at end of base . . . hinged wheel guard cover eases change . . . ramped coolant tank outlet speeds clean-cut . . . electrical controls in raised enclosure for stand-up inspection.

*To Economize, Modernize With NEW*

**NORTON**  
**GRINDERS and LAPERS**

*Making better products . . . to make other products better*

District Sales Offices:  
Worcester • Hartford • New York • Cleveland • Chicago • Detroit

# Look What You Can Do

## on CINCINNATI No. 1 CUTTER AND TOOL

You can do a lot of fine work on CINCINNATI® No. 1 Cutter and Tool Grinders . . . the type of work that will help your production machines operate at higher efficiency. CINCINNATI No. 1's are designed to sharpen and recondition a variety of small- to medium-sized cutters; to sharpen them accurately, quickly, safely. The No. 1's are tops for the type of cutter and tool grinding operations shown here. Some of the reasons why include:

- Anti-friction table slide
- Cartridge type, preloaded anti-friction grinding wheel spindle mounting
- Eccentric wheelhead swivel
- Built-in reversible motor
- . . . and a dozen additional reasons

Get a copy of the catalog covering these fine Cutter and Tool Grinders, and show it to your men who are responsible for this type of work. You can count on their opinion. Brief specifications will be found in Sweet's Machine Tool File, and complete data may be obtained by writing for catalog No. M-1852.

THE CINCINNATI MILLING MACHINE CO.  
CINCINNATI 9, OHIO



CINCINNATI No. 1 Cutter and Tool  
Grinder. Catalog No. M-1852.



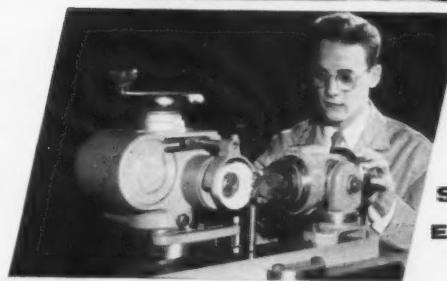
# CINCIN

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING

## GRINDERS



GRIND LATHE  
AND PLANER TOOLS\*



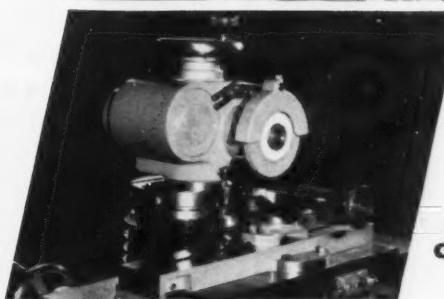
SHARPEN SHELL  
END MILL CUTTERS



SHARPEN STAGGER  
TOOTH CUTTERS



CYLINDRICAL  
GRIND DIAMETERS†



GRIND FLAT SURFACES\*

# NATI

MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

For more information fill in page number on Inquiry Card, on page 233

\*Surface Grinding Attachment. Extra equipment.

†Cylindrical Grinding Attachment required. Work  
is ground dry.

MACHINERY, January, 1957—17

# see what America's most modern power

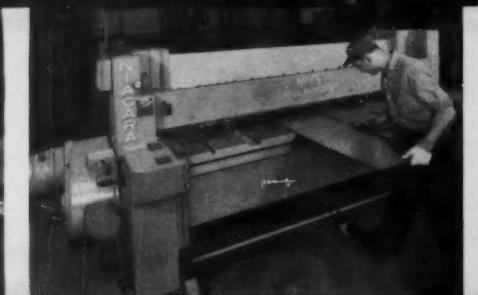


## SHEAR USERS EVERYWHERE TELL THEIR STORIES OF NIAGARA BENEFITS

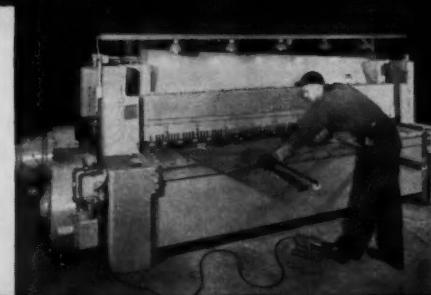
(3 of 19 Photo-Reports shown in Niagara's new Bulletin 69G)



"an exceptional machine value"  
— World's Largest Trailer Mfr.



"For over 10 years . . . we have never had  
any downtime for repairs and maintenance."  
— V-Belt Pulley and Caster Mfr.



"High quality of accuracy with the  
utmost in speed and performance"  
— Midwest Road Machinery Mfr.



# squaring shears can do for you!

**Speed that spells peak productivity! Accuracy for cutting within micrometer tolerances! Ruggedness to stand the gaff on stiffest assignments! They're all yours with a Niagara Power Squaring Shear. New, fact-filled 74-page Bulletin is profusely illustrated to show you how and why:**

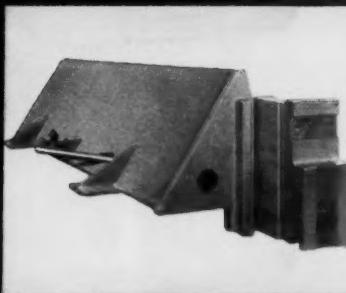
From mass producers, fabricating plants, steel warehouses and sheet metal shops comes written evidence of the superiority of Niagara Underdrive Squaring Shears on jobs of every description. *No other shear can match Niagara's record for cutting accuracy, speed and downright economy of operation.*

For a photo story of the many tangible ways in which a Niagara Power Squaring Shear can boost hourly output, improve quality and slice maintenance costs in your plant, make sure that you

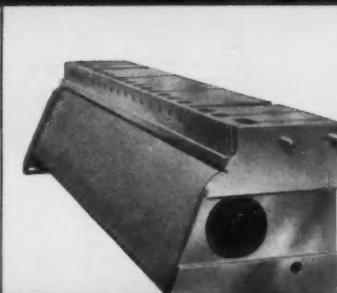
receive Niagara's newly-published Bulletin 69G by mailing the coupon below. Presenting the greatest shear story ever told this 74-page document will give you a close look at Niagara Shears in numerous applications . . . the closest look you have ever had at any shear, next to having it on your own floor! It will show you feature-by-feature why a Niagara Shear is far ahead at every point of comparison . . . and why it pays to look to America's oldest leading shear manufacturer for the most profitable answers to your requirements.

## NIAGARA-DEVELOPED FEATURES PROVIDE THE ULTIMATE IN MODERN SHEAR PERFORMANCE

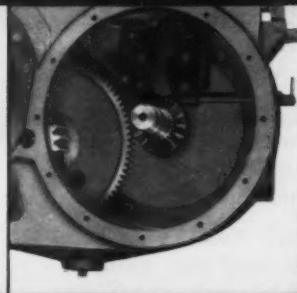
(Here's a glimpse at just a few of many. See them ALL in new Niagara Bulletin 69G)



Fully Closed Box Type Construction



Massive Bed Designed for Super Strength



Instantly Engaging Multi-Jaw Clutch



Powerful, Self-Compensating Holdown

## YOURS FOR THE ASKING...

**the most comprehensive  
shear bulletin ever published!**

Months in preparation, this fact-filled bulletin now gives you valid, inside facts on the nation's top line of power squaring shears. 74 pages! 141 revealing photographs and illustrations! Specifications for nearly five dozen standard models! Capacities: 16-gage to 1" mild steel. Cutting lengths: 4 to 20 ft. Make sure that you receive a copy at once. Mail the attached coupon today.



NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

MAIL

your new Underdrive Squaring Shear Bulletin 69G to us immediately.

MM

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

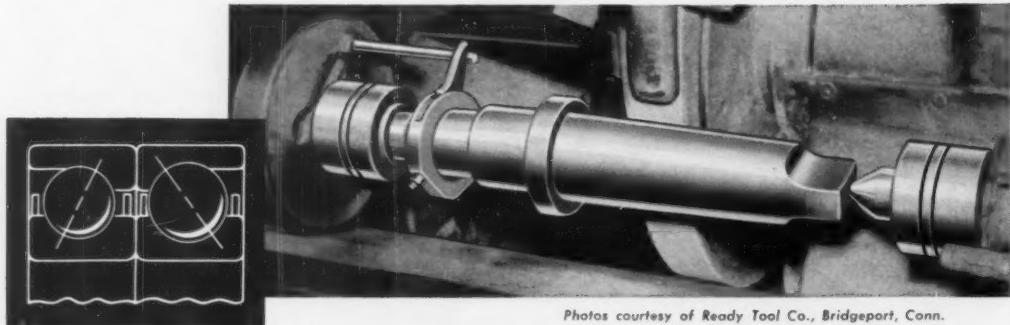
ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

# FACTS

about

## NEW DEPARTURE BALL BEARINGS



Photos courtesy of Ready Tool Co., Bridgeport, Conn.

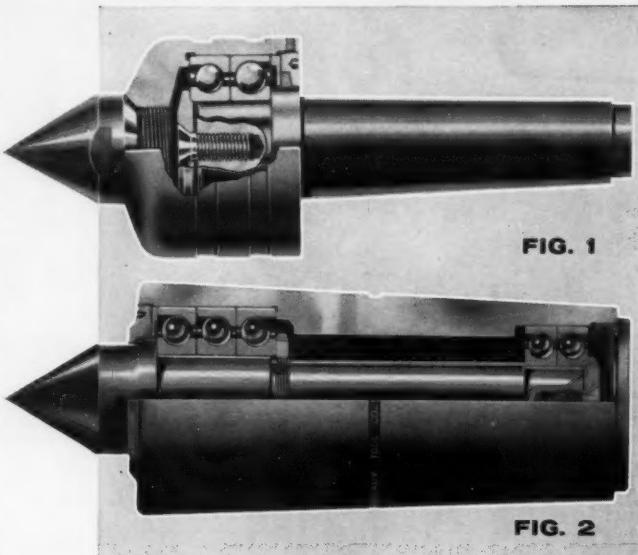
### **PRELOADED BALL BEARINGS HELP CENTER MAKERS GUARANTEE ACCURACY TO WITHIN .000050"!**

Accuracy . . . to within less than .000050" total indicator run-out! That's the performance live centers designed around New Departure preloaded ball bearings deliver!

Such super accuracy of work stems from extreme rigidity . . . the unsurpassed ability of these preloaded duplex ball bearings to handle combination loads with minimum deflection.

In live center applications, New Departure ball bearings with medium and high contact angles are mounted duplex and positively clamped together to assure the correct predetermined preload condition. As work expansion increases the thrust load, radial centering becomes more rigid and accuracy is precisely maintained.

New Departure ball bearings for live center applications are made to ultra-precision tolerances. Smooth operation with low frictional loss is assured, as well as continuity of accuracy throughout long life. Write for further details.



(Fig. 1) Tapered-shank, spindle-type center in which New Departure ABEC 7 specification duplex ball bearings support grinding loads with undiminished accuracy throughout long use.

(Fig. 2) Enclosed spindle designed around five New Departure ultra-precision preloaded duplex ball bearings.

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

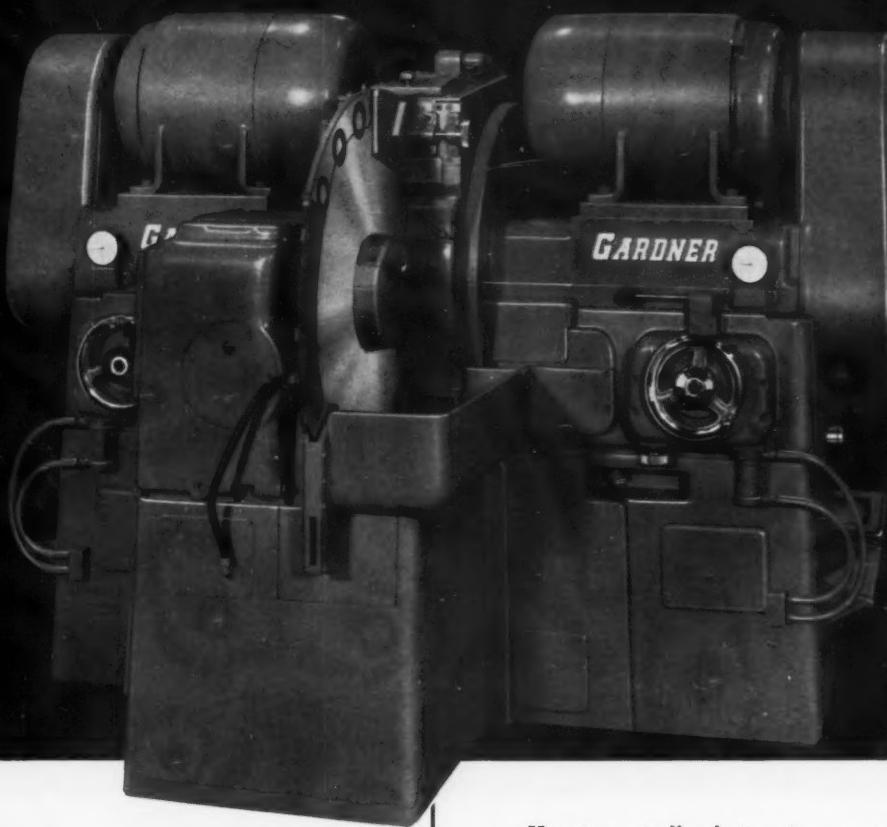
**BALL BEARINGS MAKE GOOD PRODUCTS BETTER**

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

# **NEW 2H30 Double Spindle Grinder . . .**

**new spindle design improves precision—stability increased by 500%**

**grinds TWO parallel surfaces in ONE operation**



***NEW heavier spindle***

**500% increase in stability  
at rim of 30" disc**



***OLD spindle***

Heavier spindle design in comparison with old spindle clearly shows why new 2H30 gives improved precision grinding. Note shorter spindle length combined with greater cross-sectional area that gives greater rigidity and stability. Send for your copy of the catalog describing this new Double Spindle grinder.

# **GARDNER**

**precision disc grinders  
Beloit, Wisconsin**

**the latest word in low cost machining**

# *televersal*

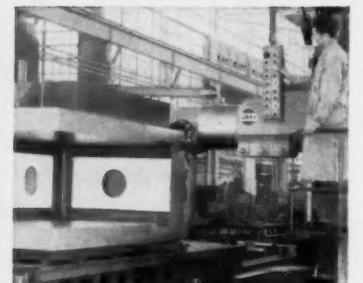
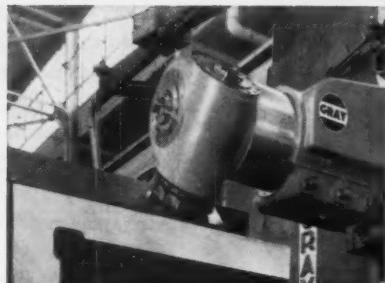
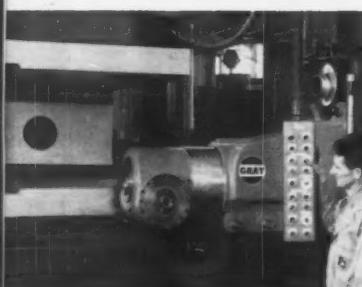
This new GRAY TELEVERSAL head tremendously increases machining range. Conveniently applied, quickly positioned, its great rigidity permits highest horsepower milling cuts.

The large diameter quill may be swiveled to permit any angular cut. A triple-straddle clamp inflexibly locks the quill to the cast pyramid body.

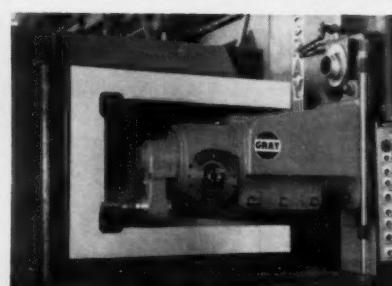
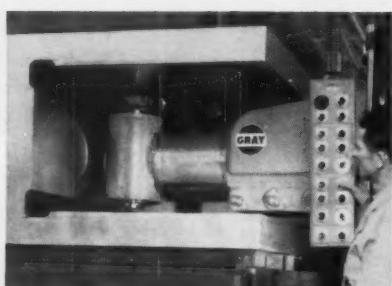
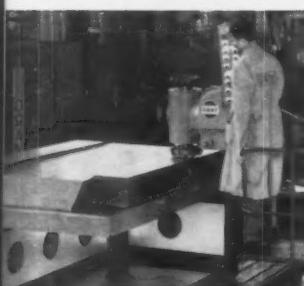
Designed to keep the job low and yet permit great machining range. Ideal when used with column cross travel of the new GRAY horizontal, boring, drilling and milling machine.

Not just an attachment, but a high power massively built, heavy milling unit that offers a new concept in versatility.

**The G. A. GRAY Co., Cincinnati, Ohio**

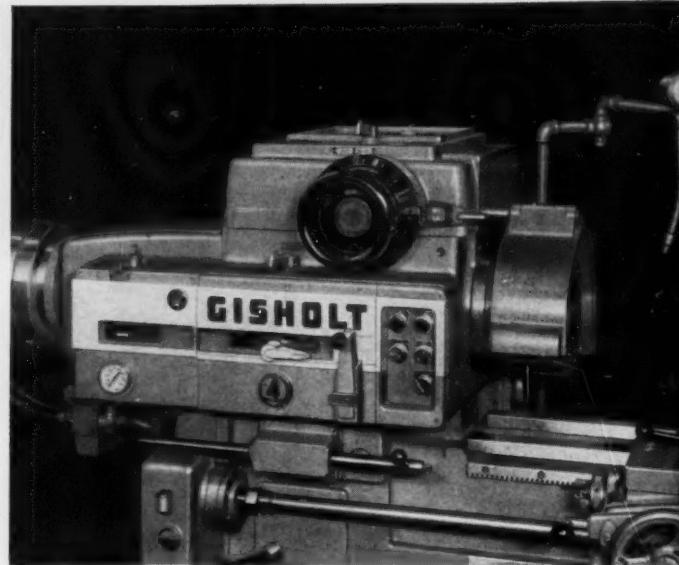
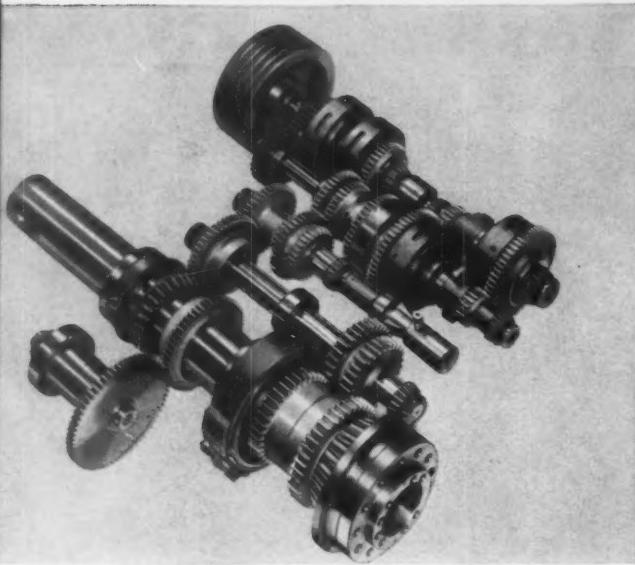


**six different surfaces and more... and only ONE work-setting**





**WANT MORE POWER, MORE SPEEDS?**



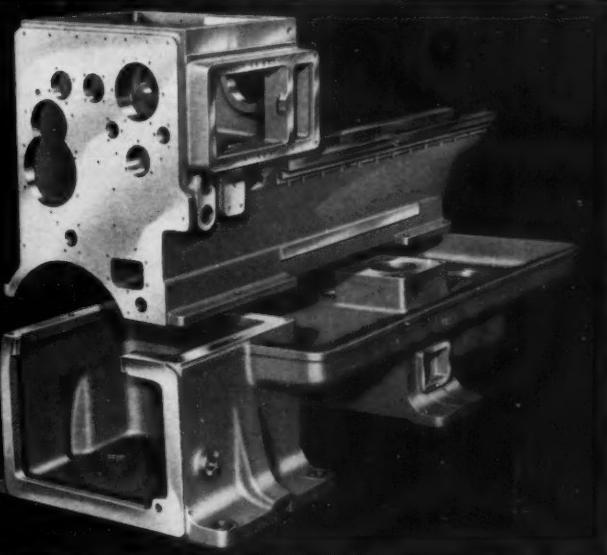
**NEW HEADSTOCK GEAR TRAIN**—sixteen different spindle speeds available, powered by up to 30 h.p. single-speed driving motor delivering full power at all speeds. Spindle is mounted on selected pre-loaded, precision-tapered roller bearings. Heavier, more rugged design provides smoother, quieter power.

**HYDRAULIC SPEED SELECTOR**—smooth, effortless speed changes. No waiting, no computing, no stopping of spindle, no releasing of main drive clutch. Operates direct or pre-set. Hi-Lo Lever permits instantaneous speed changes in 8:1 ratio without moving Speed Selector handwheel. Multiple Disc Clutches have automatic take-up for wear.

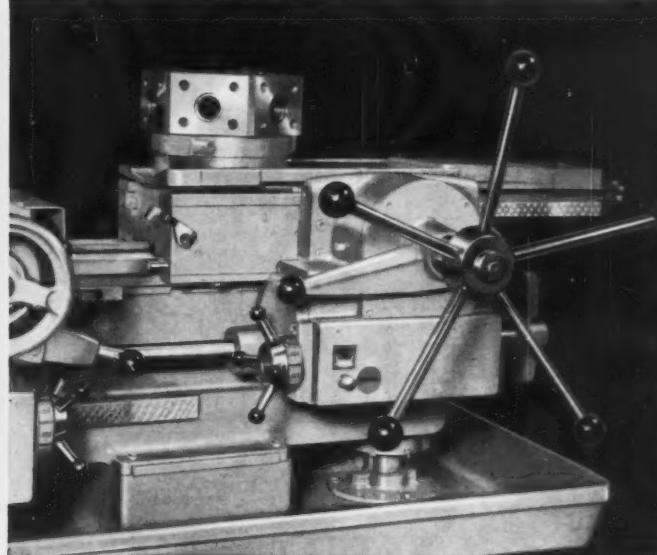
**YOU GET THEM ALL...PLUS**  
**NEW GISHOLT MASTERLINE**



# WANT HEAVY CUTS WITHOUT VIBRATION?



**NEW HEADSTOCK AND BED CASTING**—scientific design dampens out vibrations, assures smooth operation and simplifies holding closer tolerances. Made from semi-steel, poured in Gisholt's own foundry. Greater swing over ways permits bigger chucks and broader range of workpiece sizes. Provides a solid foundation for all types of work.



**NEW TURRET RAM AND SADDLE**—designed wider, heavier, more rigid to handle increased capacity and higher speeds. Dial-type feed selector makes feed changes faster, easier. Turret ram rigidly supported on 64-66 Rockwell C alloy steel way strips. Power transmitted through serrated tooth clutches, with shear pin protection against overloading.

## GREATER VERSATILITY...WITH THE RAM TYPE TURRET LATHE

**YOU'LL SPEED UP** your production jobs—both large and small—with this more powerful, more versatile Gisholt MASTERLINE Ram Type Turret Lathe.

Here is a machine designed from end-to-end for easier setups, faster change-over and higher productive output than ever before. Check the advanced features illustrated above. Note the reserve power to handle your heaviest cuts—and to meet your tooling requirements of tomorrow. Note the extra spindle speeds—all at your operator's finger tips, without computing—for faster, better turning of

any type material. And look over the new massive design, the over-all ruggedness that permits greater accuracy, closer tolerances, deeper cuts at punishing feeds without vibration.

Find out now how this powerful, flexible Gisholt MASTERLINE Ram Type Turret Lathe can reduce floor-to-floor time on your specific jobs. Call your Gisholt Representative today—let him show you how this advanced machine can fit most profitably into your production picture. Or write direct to Gisholt for the new literature described below.

**READY NOW**—all-new, 18-page illustrated Bulletin No. 1174-B, covering features, accessories, tools and floor plans on new Gisholt MASTERLINE Ram Type Turret Lathes. Ask for it!



# GISHOLT

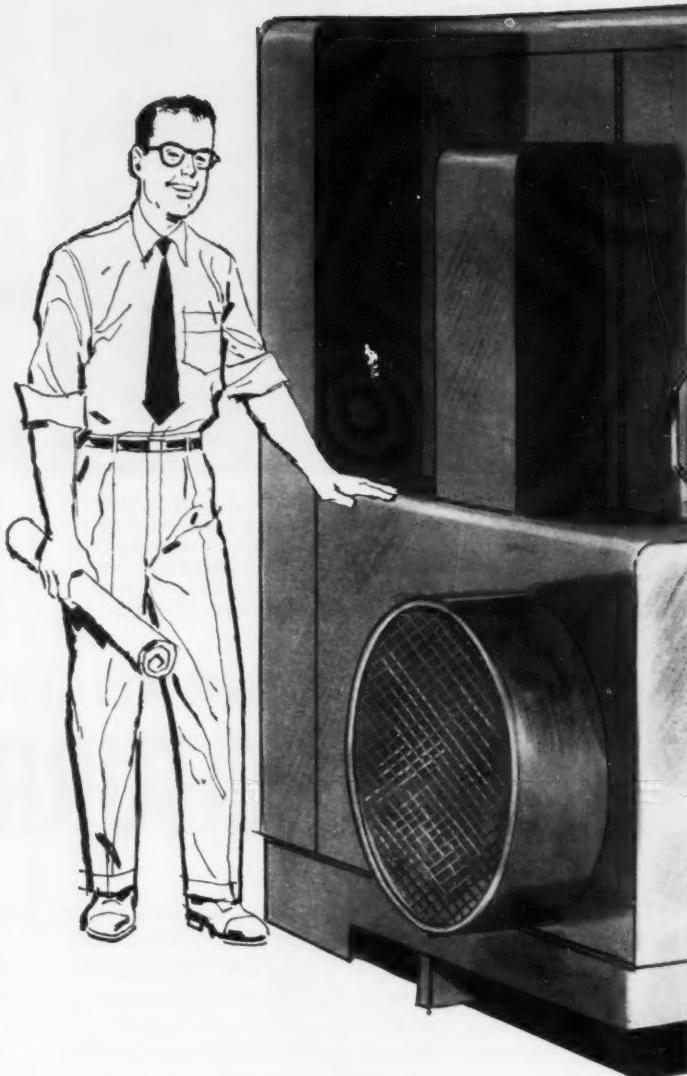
MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

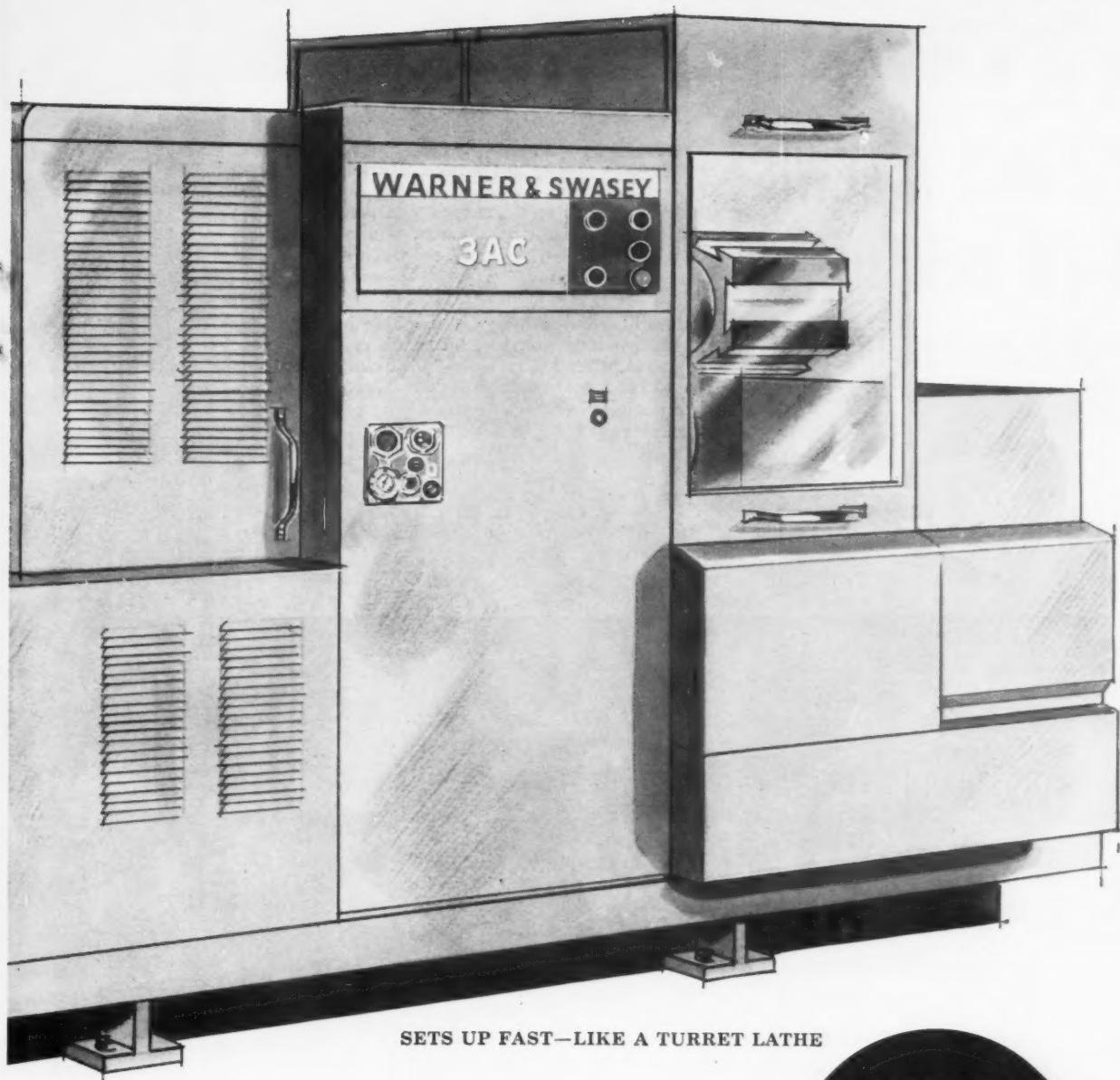
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

# New Warner & Swasey 3AC

**SINGLE SPINDLE  
AUTOMATIC CHUCKER**  
widens field of  
profitable turning jobs



This versatile, new model was engineered for fast, automatic machining of your larger, complex chucking jobs. It provides accuracy, metal removal capacity, tooling flexibility and set-up ease and speed heretofore unobtainable by automatic operation in this work range.



SETS UP FAST—LIKE A TURRET LATHE

For over eight years, enthusiastic users have told us, "Performance records of our Warner & Swasey Single Spindle Chucking Automatics have been phenomenal."

The 1AC model, first introduced at the 1947 Machine Tool Show in Chicago, met with instant field acceptance. In 1953 — 88 customers placed orders for the 2AC model before the first machine was ever built!

Now, Warner & Swasey announces a new, larger capacity, more powerful 3AC model with a 15-inch diameter chuck and a 40-horsepower motor, which will provide fast, automatic production for your larger pieces — precision and otherwise — in all lot sizes.

Our Field Representative will be glad to give you complete details on how this new machine can increase profits on your operations. Why not call him in, today?

For more information fill in page number on Inquiry Card, on page 233

**WARNER  
&  
SWASEY**  
*Cleveland*  
PRECISION  
MACHINERY  
SINCE 1880

No matter which way  
you turn...

Warner & Swasey  
cuts costs

# GIDDINGS & LEWIS 8-FT. VERTICAL turning and boring mill

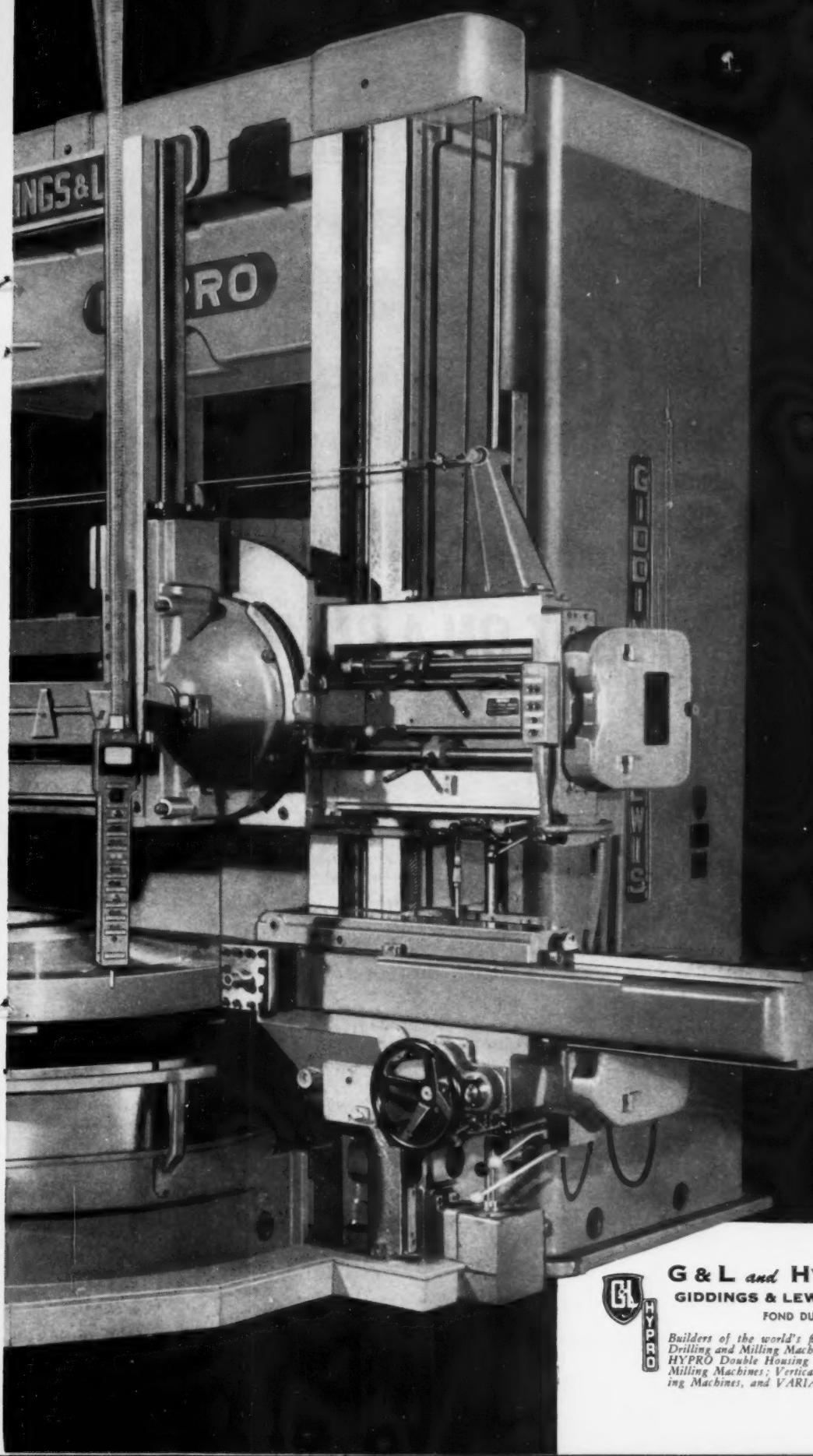


LITERATURE AVAILABLE:  
Write for complete descriptive  
Bulletin No. 54-12 on HYPRO Vertical  
boring and turning mills.

Today's production demands greater accuracy and speed in boring and turning operations. Pacing progressive machining methods is this HYPRO Vertical mill, equipped with optional tracer-controlled duplicating device — micrometer adjustment to stylus, remote speed control to adjustable voltage drive, constant controlled cutting speed and chip thickness.

HYPRO Vertical mills are available in 12 standard models with table diameters ranging from 54" to 12' and table work-load capacities up to 125-ton . . . motor drives up to 100 hp. For complete information, see your nearest G&L representative, or write direct.



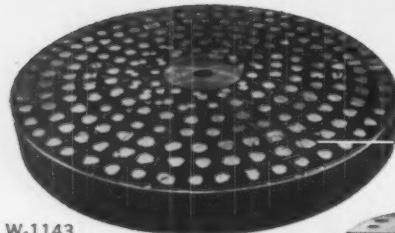


**G & L and HYPRO DIVISION**  
**GIDDINGS & LEWIS MACHINE TOOL CO.**

FOND DU LAC, WISCONSIN

G-68

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.



tiny or tremendous...



## For best results... **PUT IT ON A BLANCHARD!**



Blanchard No. 18



Blanchard No. 42-84

There's a Blanchard for every surface grinding job, in a broad range of sizes. For example, the Blanchard No. 18 grinds non-magnetic transistor elements (upper left) .006" thick, to a tolerance of .0005" with good finish. This job, which involved .006" to .008" stock removal per side, was held on special fixture plates.

At the other end of the scale, a huge Blanchard No. 42-84 Grinder grinds a turbine housing (upper right) which measures 83" across the corners, and is 28" high. This housing, ground after rough machining, required .020" stock removal. Both this piece and its mating part were ground to a steam-tight joint.

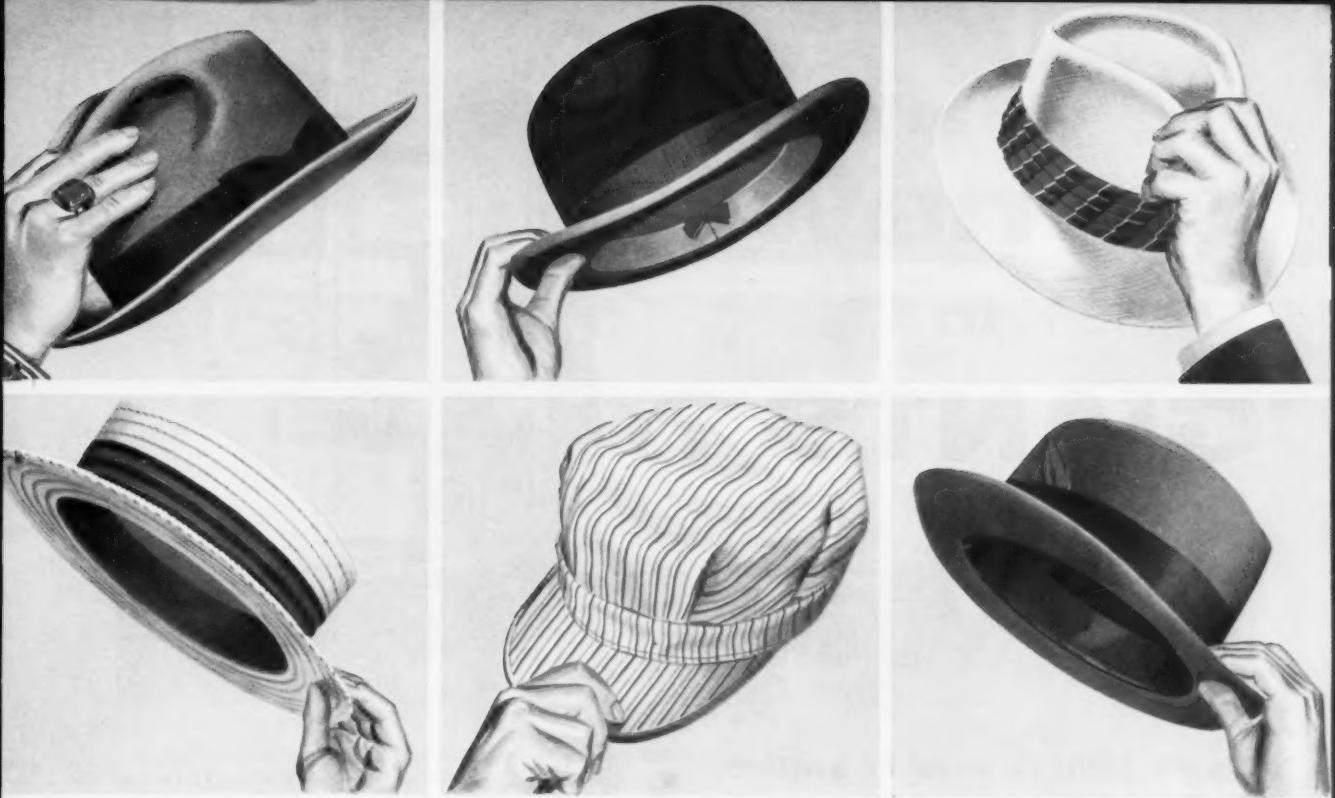
Whatever you're grinding — be it tiny watch parts, giant steel plates, or anything in between — there's a Blanchard designed to do the job speedily and accurately.

Ask for details on the 15 standard Blanchard models.

**PUT IT ON THE**  **BLANCHARD**

Send for free copies of "Work done on the  
Blanchard", fourth edition, and "The Art  
of Blanchard Surface Grinding".

**THE BLANCHARD MACHINE COMPANY** 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.



## Why hats are off to CIMCOOL...

...because CIMCOOL® has become, in just a few years, the largest selling cutting fluid in the world. And sales of this radically new and different coolant are continuing to climb because CIMCOOL Standard Concentrate has two big advantages over old-fashioned cutting fluids:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

We'll be happy to supply information on the many specific advantages of CIMCOOL Standard Concentrate—or details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

® Trade Mark Reg. U.S. Pat. Off.

### CIMCOOL CUTTING FLUIDS

**CIMCOOL Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

**CIMCOOL Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

**CIMPLUS**—The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

**CIMCUT**—Base Additive—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

**CIMCOOL Bactericide**—The most effective agent yet developed to overcome rancidity and foul odors.

**CIMCOOL Machine Cleaner**—The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

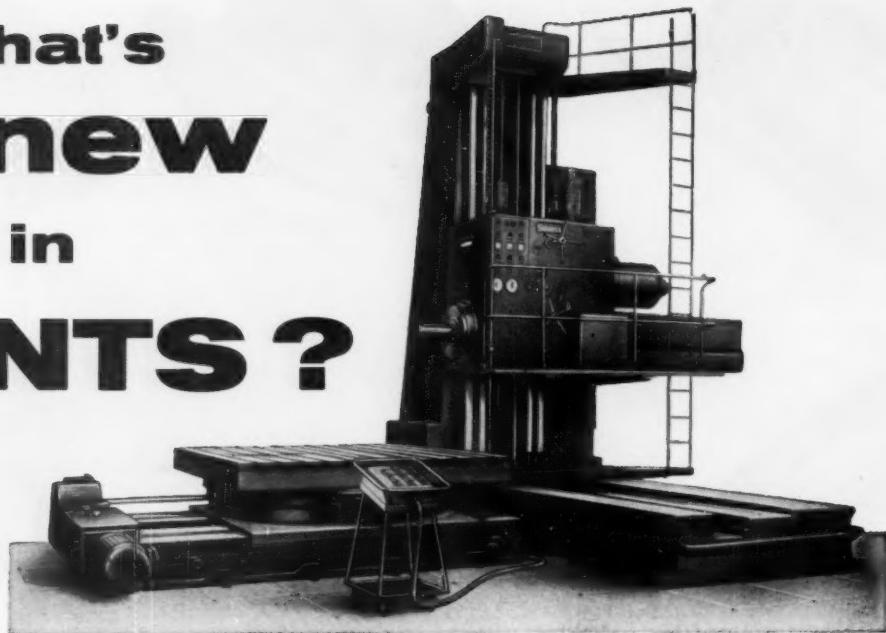
# CIMCOOL

## Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

**what's  
new  
in  
GIANTS ?**



**This 8½" SCHIESS model BF horizontal boring and milling machine . . .** Now completely redesigned with many innovations. Here are a few . . .

Two individual drives—gear-drive for roughing, belt-drive for finishing. Belt-drive particularly suited to high-speed machining with carbide tools. New tool clamping device—does away with draw keys, hammers, drifts and binding screws. All spindle-slide movements controlled from easily accessible operating platform (or from pendant station or portable control panel, if desired). Special

main-drive belt requires no readjusting. Column, spindle-slide and boring spindle may be adjusted at rapid traverse.

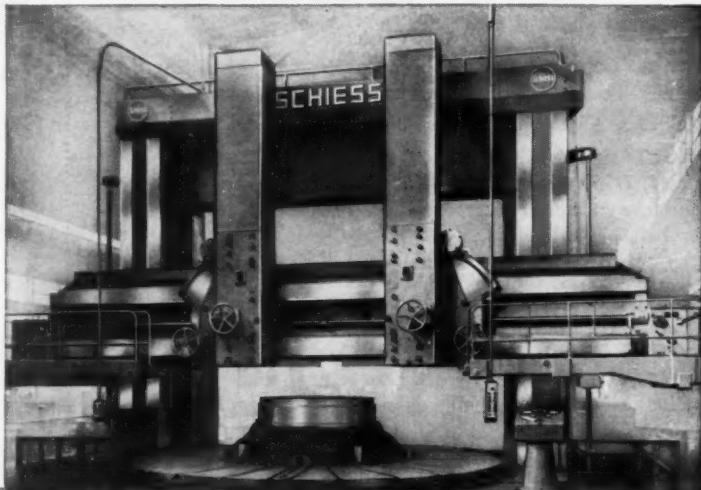
Spindle diameters, 6½" to 8½". Maximum diameter bored, 59"—faced, 79".

It takes Europe's largest builder of heavy machine tools, Schiess, to turn out giants like these. Parts and service as close as Pittsburgh. And an American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all Schiess BF and K models.

**This 23 ft. SCHIESS model K vertical boring mill . . .**

Look at all these new features—each one a time-saver! Rapid traverse motions with pushbutton control of changeover from feed motion to independent power traverse. Electro-mechanical locking of cross-rail to columns. Fingertip speed control—counter-balanced cross-rail and side-head—completely enclosed swiveling octagon rams—pendant control—automatic lubrication.

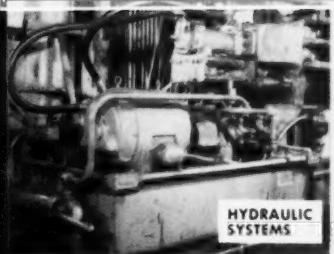
Turning diameters in standard sizes range from 8 ft. to 23 ft. (which can handle stock up to 100 tons!). Basic Schiess designs permit extra heavy machines, normally considered specials, to be built to your work diameter and load requirements. Even a diameter of 84 ft.!



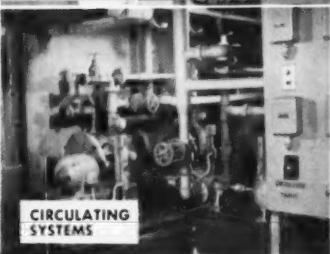
engineering division

AMERICAN SCHIESS CORPORATION

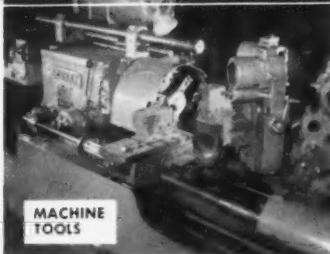
1232 Penn Avenue, Pittsburgh 22, Pa.



HYDRAULIC  
SYSTEMS



CIRCULATING  
SYSTEMS

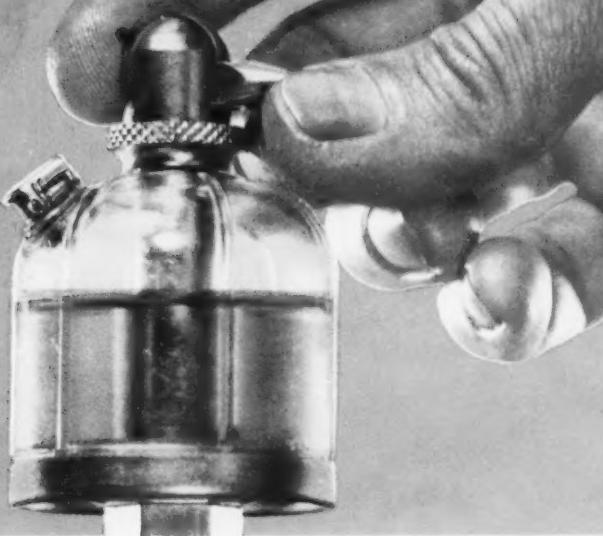


MACHINE  
TOOLS



AIR  
COMPRESSORS

GENERAL LUBRICATION



## SUN SOLNUS OILS IDEAL LUBRICANTS FOR 80% OF ALL APPLICATIONS

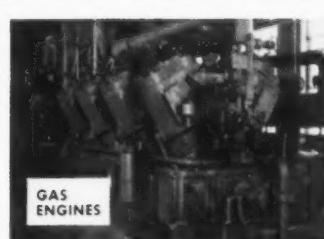
Moderately priced...low in carbon-forming tendencies, Sun Solnus® oils simplify your storage problems by doing with one oil many jobs that would otherwise require several. Their ability to protect metal parts against corrosion, their resistance to oxidation, and their moderate price all add up to "more lubrication per dollar."

For technical information, see your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-51.



INDUSTRIAL PRODUCTS DEPARTMENT  
**SUN OIL COMPANY**  
PHILADELPHIA 3, PA. ©SUN OIL CO.

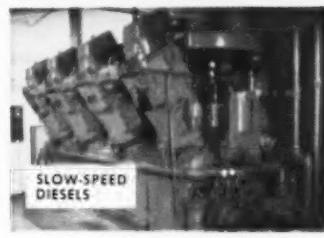
In Canada: SUN OIL COMPANY LIMITED, Toronto and Montreal



GAS  
ENGINES



GEAR  
BOXES



SLOW-SPEED  
DIESELS



Valve on left is from compressor run for 3,000 hours with well-known, high-grade oil. At right is same valve after a 3,000-hour run with Sun Solnus oil. Note difference in carbon deposits.

## 3000-HOUR TEST PROVES SUN SOLNUS OILS REDUCE CARBON BUILD-UP IN COMPRESSORS

**Equipment:** A three-stage Norwalk horizontal-type compressor. Operating pressure: from 1,000 to 1,500 psi.

**Test:** The compressor was cleaned thoroughly and filled with a well-known, high-grade oil. The equipment was run for 3,000 hours, then torn down for inspection and cleaning. Then Solnus® 300 was tested in the same way.

**Results:** Look at the two pictures. You can see for yourself how Solnus oil reduced dangerous carbon build-up.

All types of reciprocating air compressors that have been changed over to a Sun Solnus oil show similar results. A test in your compressor will show the same remarkable reduction of carbon deposits.

You can get a technical bulletin about Sun Solnus oils by asking your Sun representative, or write to **SUN OIL COMPANY**, Philadelphia 3, Pa., Dept. I-52.



**INDUSTRIAL PRODUCTS DEPARTMENT**

**SUN OIL COMPANY** **PHILADELPHIA 3, PA.**

IN CANADA: **SUN OIL COMPANY LIMITED**, TORONTO AND MONTREAL

© SUN OIL CO.

It's easy to  
**CUT WELDING COSTS**

when you use a High-Speed

**LINDE SWM-2**

Trade-Mark

**Portable Sigma Welder**

Your welding department can easily make high-speed, low-cost fusion welds in aluminum, stainless steel, high temperature alloys, copper, carbon steel, and other metals with the LINDE SWM-2 Portable Sigma Welder. The LINDE SWM-2 is a complete control unit for manual sigma (Shielded Inert Gas Metal Arc) welding operations. It mechanically feeds welding wire from a coil into the weld area at a steady precontrolled rate and supplies a regulated quantity of argon to shield the weld from contamination by the atmosphere. No flux is used. In most cases the smooth, clean sigma welds need no post-welding treatment.

**SIMPLIFIED AUTOMATIC OPERATION**

The operator merely presses the trigger of the pistol type torch to energize the control circuit and start the flow of water coolant and argon gas. When an arc is struck by touching the consumable electrode to the workpiece, the wire feed automatically begins.

**NEW CONSTANT POTENTIAL POWER SUPPLIES CAN BE USED**

Either ordinary or constant potential DC power supplies can be used with a LINDE SWM-2. In constant potential welding arc voltages are preselected and held with outstanding consistency which permits positive starts and high-speed welds on thin metals.

*Call* your nearest LINDE office today for more information on how you can cut production welding costs with the LINDE SWM-2 Sigma (Shielded Inert Gas Metal Arc) Welder. Or write for your free LINDE SWM-2 catalog.

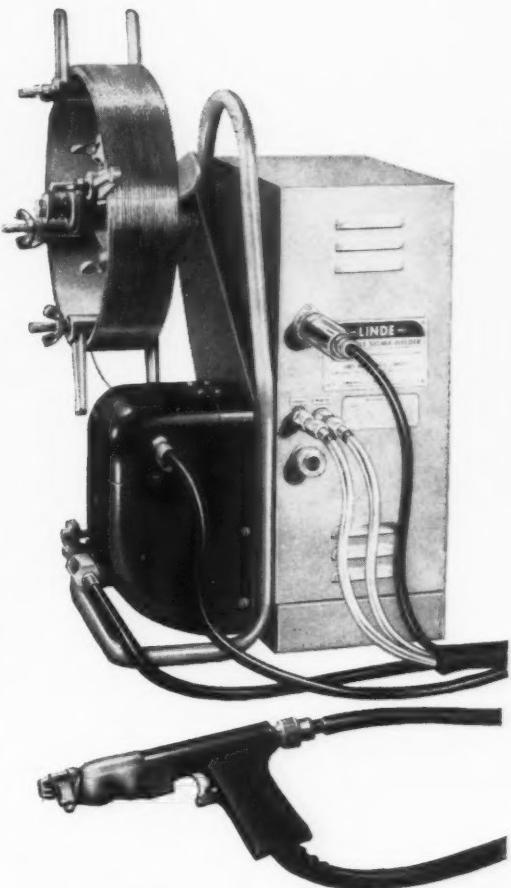
**Linde Air Products Company**  
A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.  
Offices in Other Principal Cities

In Canada: LINDE AIR PRODUCTS COMPANY  
Division of Union Carbide Canada Limited, Toronto  
(formerly Dominion Oxygen Company)

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

For more information fill in page number on Inquiry Card, on page 233



Production jumped 300% when the Heller Engineering and Manufacturing Company, Lynwood, California changed to sigma welding to fabricate aluminum engine shipping stands. Because the sigma welds were clean and sound, post-welding treatment was practically eliminated.

*Linde*  
Trade-Mark

THE  
**BULLARD**  
COMPANY

*Announces the acquisition of the*

**HYDRA-  
FEED**  
*Lathe—*

(formerly manufactured by Hydra-Feed Machine Tool Corp.)



The name "Bullard" on machine tools dates back over three quarters of a century . . . to 1880.

Bullard tradition stands for advanced engineering,

quality of craftsmanship and reliable performance.

These same attributes will continue to be our constant goal in the future.

THE BULLARD COMPANY  
BRIDGEPORT 9, CONNECTICUT

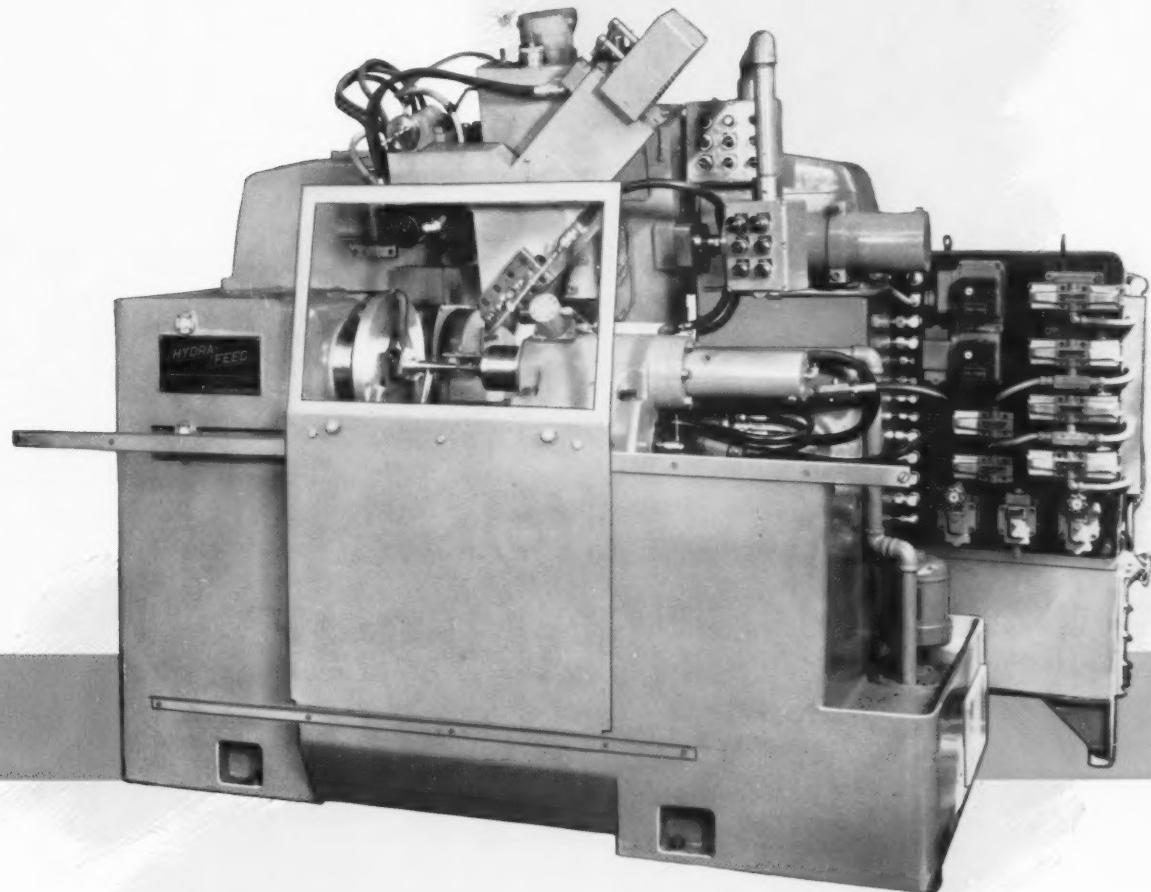
## **OUTSTANDING FEATURES INCLUDE:**

**Unobstructed front view design allows faster loading  
and unloading . . . easier set-up . . . with less operator fatigue.**

**When used as a tracer lathe templates are above  
work piece where dirt, chips and cutting oils  
cannot interfere with work accuracy.**

**Oversized chip chute with pan below the entire work area . . .  
readily accessible from end, rear or bottom of machine.**

**Massive strength and rigidity with extra power to take  
full advantage of maximum feeds and speeds  
obtainable with multiple carbide tooling.**



**Fill Out The  
Coupon Now**

**THE BULLARD COMPANY  
286 CANFIELD AVENUE, BRIDGEPORT 9, CONNECTICUT**

Please send me a copy of the BULLARD HYDRA-FEED LATHE CATALOG

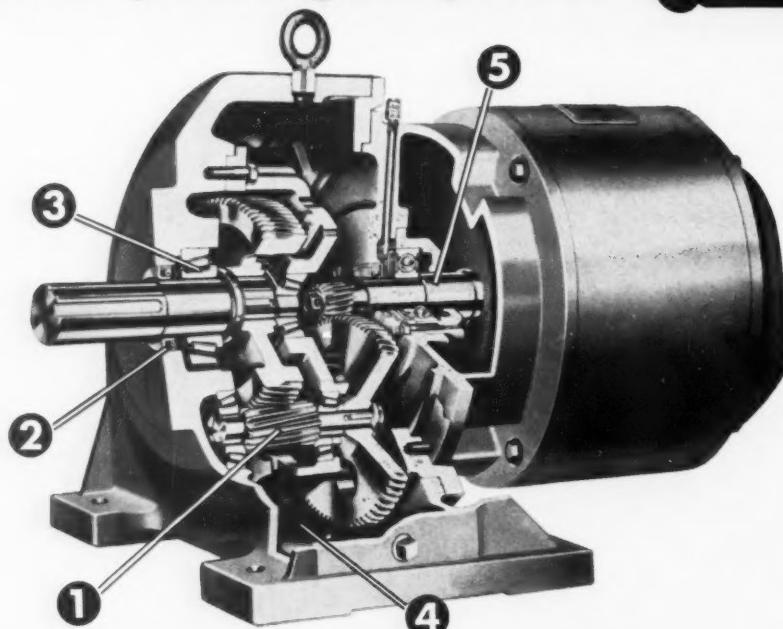
NAME \_\_\_\_\_

COMPANY \_\_\_\_\_ POSITION \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

# new packaged-power GEARMOTOR



1. HELICAL GEARING assures silent operation, increased strength, longer life and minimum friction loss. Teeth are crown shaved and induction hardened for optimum performance.
2. TWO-WAY SEALS lock oil in, and seal dirt out.
3. OVERSIZE THRUST BEARINGS handle big overhung loads.
4. OIL BATH LUBRICATION keeps gears and bearings continually showered with clean oil.
5. HEAVY SHAFTING, heat treated alloy steel, eliminates possibility of bending or twisting under heavy loads.

... gives you these unexcelled construction features



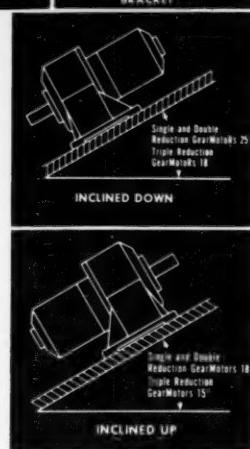
## ... plus real Mounting Flexibility



Exceptional compactness and flexibility eliminate need for costly, special gear units to fit difficult and unusual mounting conditions. For mountings inclined more than shown, a special oil seal arrangement is provided.

For Vertical shaft-down applications, a special Vertical GearMotoR provides a completely leakproof output shaft, through the exclusive Philadelphia "Dry Well" housing construction.

Send for Catalog GM-560 which fully describes and illustrates the new Philadelphia GearMOTRs, Utility type GearMOTRs, In-Line Reducers and Motorized Worm Gear Drives.



# phillie gear®

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

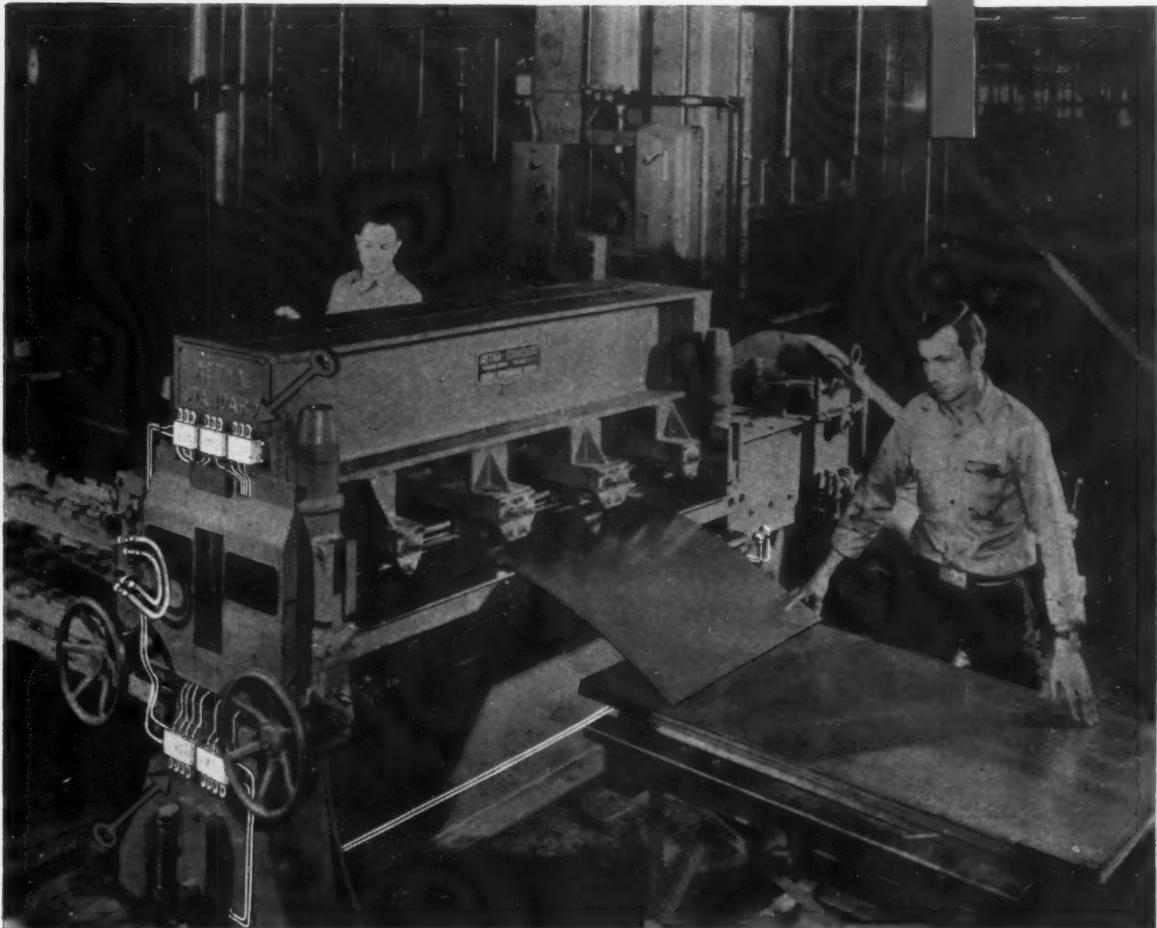
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

# Continuous, high-speed sheet levelling calls for continuous, precision lubrication

FARVAL—  
Studies in  
Centralized  
Lubrication  
No. 192



• Wherever high speed and heavy shock loads are involved, adequate lubrication of bearings is a must. It can't be a hit-and-miss proposition—there's too much at stake with costly machines and continuous production lines. The operation above is a good example. Here an Aetna-Standard sheet leveller flattens sheets at high speed. Failure or inaccuracy interferes with succeeding forming and stamping operations. With Farval on guard, such eventuality will not occur.

Farval delivers a measured amount of clean lubricant to every bearing at regular intervals. No bearings are ever missed—and the amount delivered to any bearing can be varied without affecting the rest of the system. Farval saves production hours, maintenance, labor.

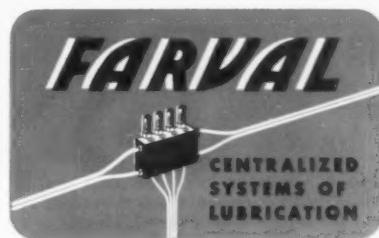
Ask, now, for a free lubrication survey. Let us send one of our lubrication engineers to inspect your plant equipment. Without obligation, he will present a written analysis of what Farval can do for you. Write the Farval Corporation, 3276 E. 80th St., Cleveland 4, O.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing.  
In Canada: Peacock Brothers Limited.

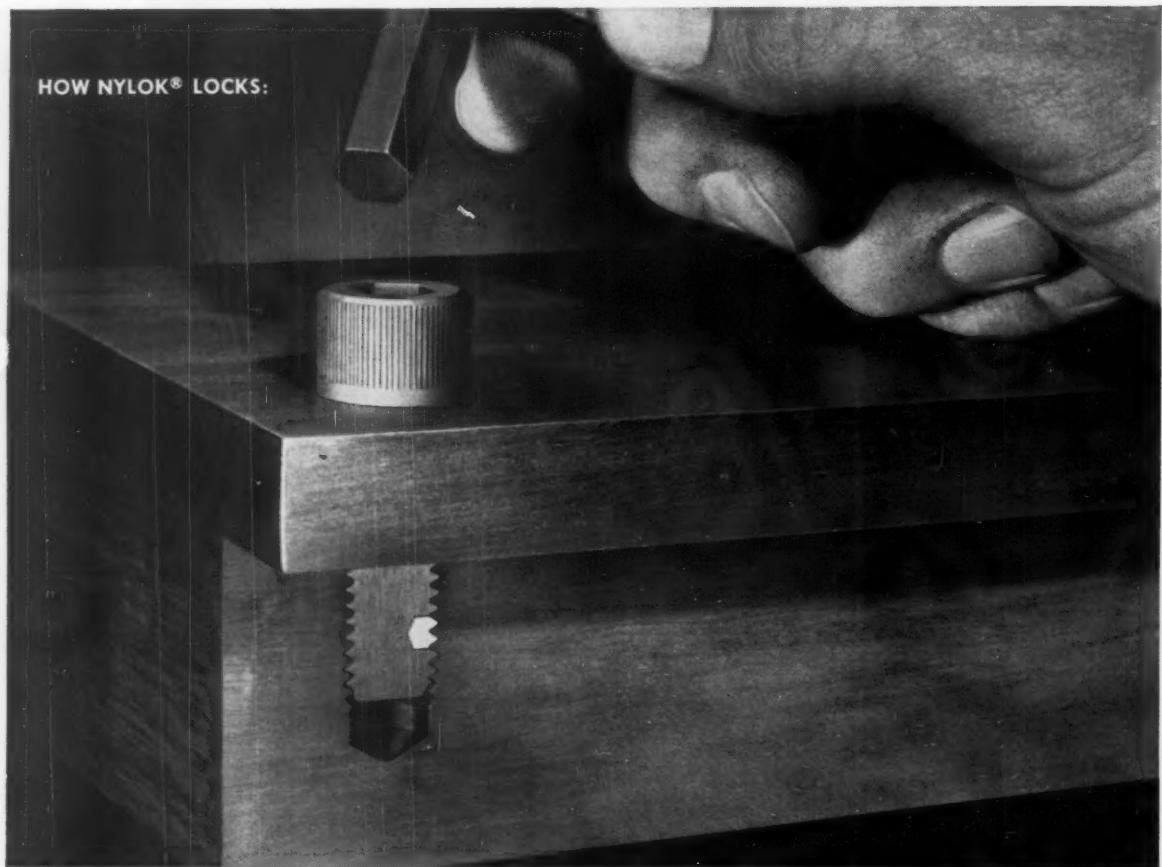
## KEYS TO ADEQUATE LUBRICATION—

Wherever you can see these Farval manifolds, dual lubricant lines and central pumping station, you know a machine is being properly lubricated.

Here, Farval serves an Aetna-Standard leveller in an Ohio metalworking plant.

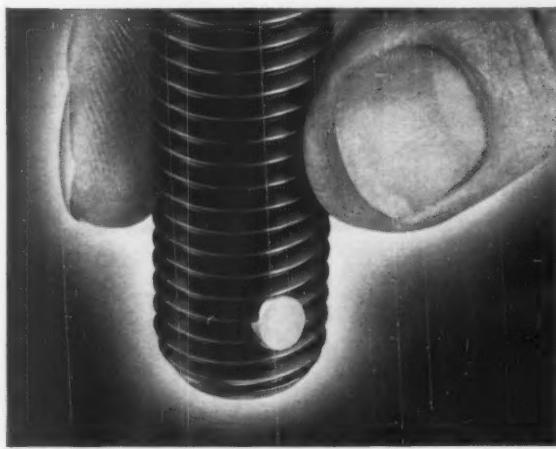


# NEW—a complete line of socket screw products

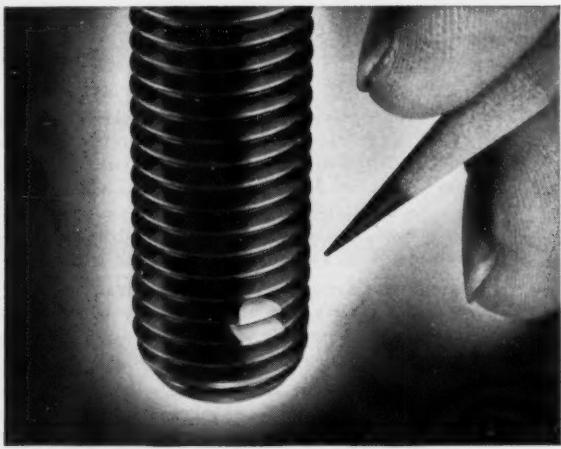


HOW NYLOK® LOCKS:

**LOCKED!** The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.



**BEFORE ASSEMBLY.** The nylon pellet projects slightly beyond male threads. When assembled, female threads will be impressed into it. Pellet locks effectively whether the screw is seated or not.



**AFTER REMOVAL.** "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

# self-locking UNBRAKO that won't work loose

**They simplify design and  
save production time**

UNBRAKO socket screws are now available embodying the Nylok\* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

An UNBRAKO screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. Seated or not, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not shake loose.

You save production time when you build products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lock-washers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-locking UNBRAKOS are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from -70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

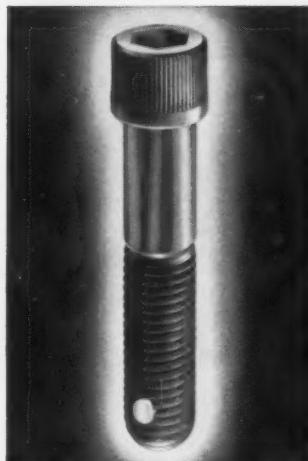
\*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

## UNBRAKO SOCKET SCREW DIVISION

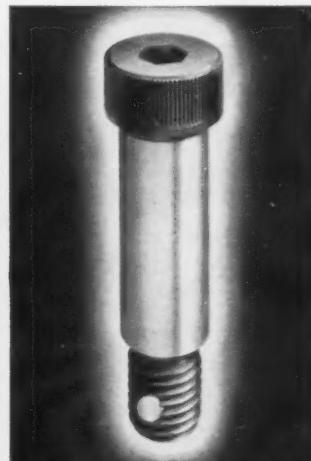
STANDARD PRESSED STEEL CO.



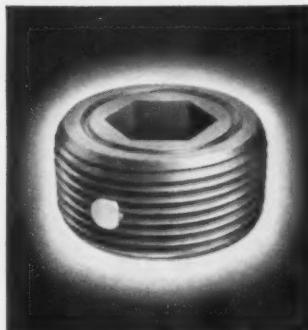
For more information fill in page number on Inquiry Card, on page 233



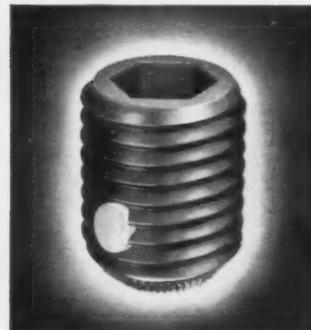
Socket head cap screws. Standard sizes #6 to 1 in.



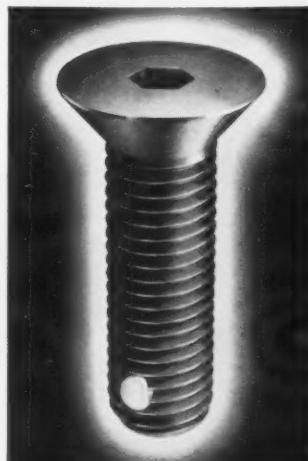
Socket shoulder screws. Standard sizes 1/4 to 3/4 in.



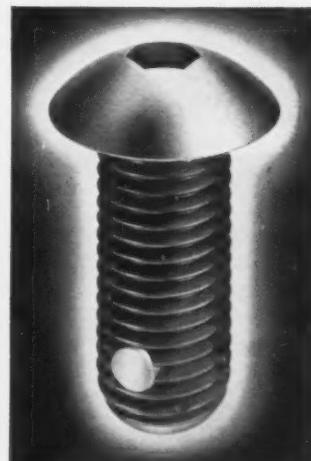
Socket pressure plugs. Standard sizes 1/8 to 1 1/4 in.



Socket set screws. All standard point types. Standard sizes #6 to 1 in.



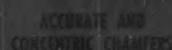
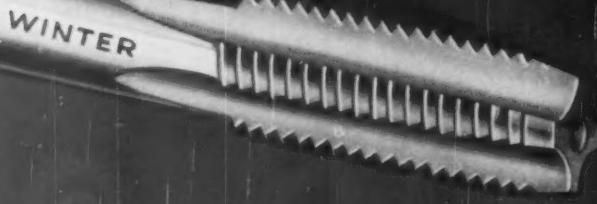
Flat head socket screws. Standard sizes #6 to 3/4 in.



Button head socket screws. Standard sizes #6 to 3/4 in.



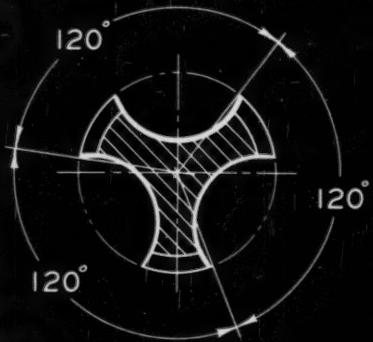
# WINTER



BALANCED  
ACTION  
brings you  
lasting satisfaction  
with your  
tapping operations

When tool manufacturing is planned and carried through with extreme care, you get exceptional accuracy and long tool life. Winter has proved this through the steady year-to-year increase in users of Balanced Action Taps.

CALL YOUR  
WINTER DISTRIBUTOR



Flute spacing must be exact in a tap that performs with Balanced Action. This is the first of four craftsmanship qualities manufactured into every Winter Tap.

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit  
• Cleveland • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.



## A search that never ends

The quest for better ways to cut metals is continuous in National's testing laboratories. When worthwhile improvements are found, the benefits are made available to you through better performance of National Tools.

### NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles



TWIST DRILLS  
REAMERS  
COUNTERBORES  
MILLING CUTTERS  
END MILLS  
HOBS  
CARBIDE AND  
SPECIAL TOOLS



CALL YOUR  
NATIONAL  
DISTRIBUTOR

# National



---

*Ask* **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

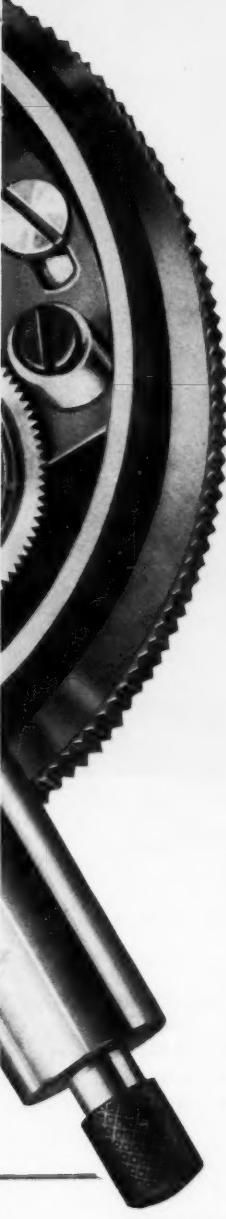
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

---

# A LIFETIME DIAL INDICATOR

## HEAVY DUTY MODEL

with the maintenance-free "H" Movement



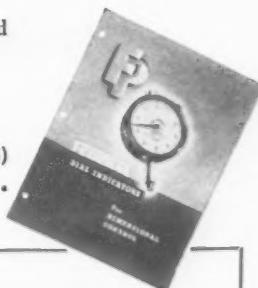
**Rugged — shockproof — withstands more impact.**  
**Improved life under all conditions. All gears, racks,**  
**and pinions precision hardened — friction reduced 16%**  
**to 25%, depending upon magnification . . . a new high in**  
sensitivity. Calibrated accuracy greatly improved. Off-white  
dials and fine line graduations facilitate readings. Available  
in four sizes. Enthusiastically received in shop tests.

### You can get the NEW FEDERAL Dial Indicator:

- In 47 Regular Models (Any B, C, D, or E Size Model listed on page 4 of the Catalog)
- In 7 Wetproof Models (All Wetproof Models listed on page 6 of Catalog)
- In 2 Long Range Models (C8IS and D8IS, shown on page 7 of Catalog)

TO SPECIFY . . . the NEW style Hardened Gear Indicator, merely add "H" after Model No. desired.

If you don't have the NEW DIAL INDICATOR CATALOG (No. 55) and PRICE LIST, be sure to fill out coupon and mail it today . . .



#### FEDERAL PRODUCTS CORPORATION

7111 Eddy Street, Providence 1, R. I.

Please send Dial Indicator Catalog 55

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_



## Steel cylinder weighs 83 tons, has walls $10\frac{1}{4}$ in. thick

This burly giant of molybdenum-vanadium steel is the main cylinder of a 7500-ton plate-stretcher. Forged and machined in the Bethlehem shops, it was successfully tested for 50,000-psi minimum yield point.

The big cylinder weighs better than 83 tons; is 17 ft 3 in. long, has an ID of 70 in., and a maximum OD of 105 in. at the collar. To withstand the tremendous pressures that will

be generated in service, a wall thickness of  $10\frac{1}{4}$  in. was provided.

The forging well illustrates Bethlehem's capacity for heavy work of this nature. Bethlehem shops are fully able to produce the largest, heaviest pieces ever required. But let us emphasize that we're equally well set up for the smaller items, including all types of drop, upsetter, and specialty forgings.

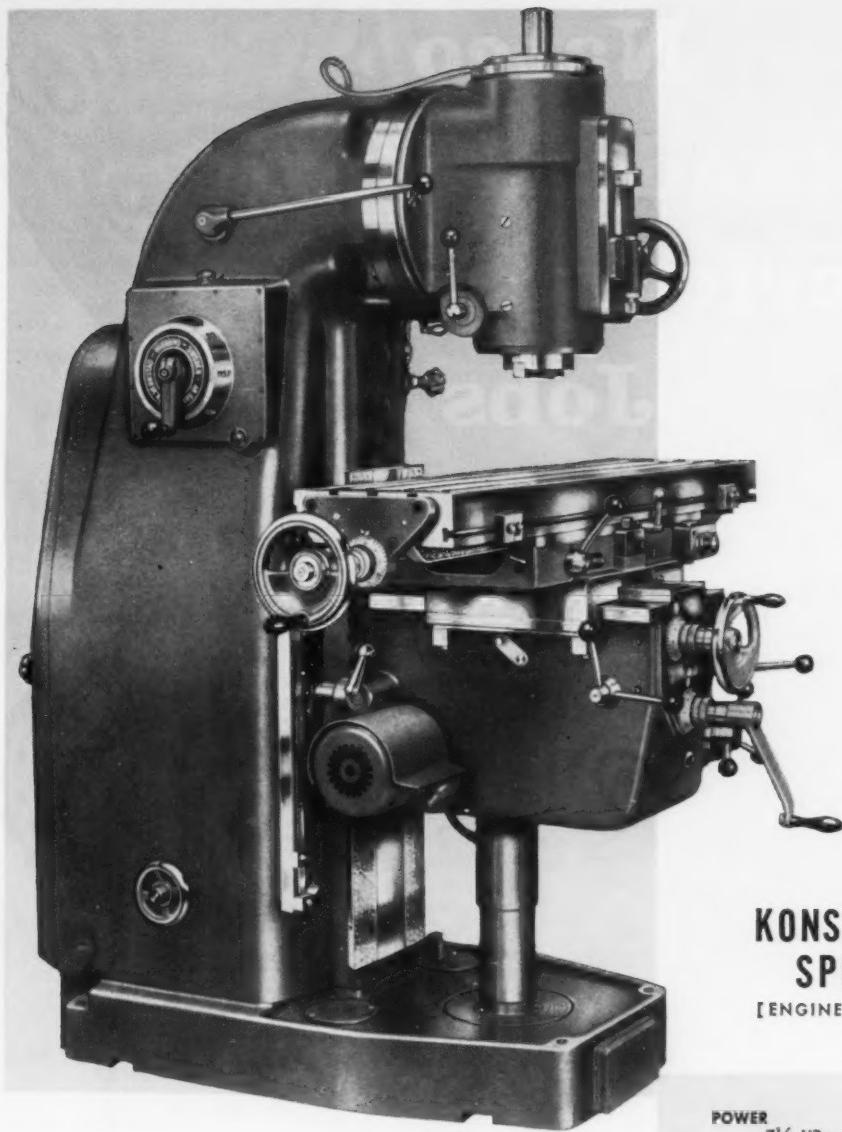
Whenever we can be of service to you, please call or write. You will find our engineers particularly helpful and cooperative. They'll work with you all the way on any forging problems you may have.

BETHLEHEM STEEL COMPANY  
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by  
Bethlehem Pacific Coast Steel Corporation  
Export Distributor: Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**





## KONSTRUERAD FÖR SPECIALISTER

[ENGINEERED FOR SPECIALISTS]

### SAJO'S NEW No. 2 VERTICAL MILLER MODEL VF-54

Built to U.S. Standards by Swedish craftsmen, this precision Miller meets exacting requirements at a modest price.

SAJO Model VF-54 is an ALL GEARED Vertical Miller with hand-scraped sliding surfaces, SKF "SP" anti-friction bearings on spindle and gear shafts, hardened chrome nickel gears, ground integral splines on gear shafts, externally adjustable back-lash eliminator for table feed screws, dial-selected feeds and speeds.

#### POWER

$\frac{7}{12}$  HP motor for spindle (5 HP optional).  
 $\frac{1}{2}$  HP motor for table feed and 3 direction rapid traverse.

#### RANGE

16 spindle speeds 39-1500 RPM (31-1200 optional), No. 50NMT spindle, 12 table feeds  $\frac{7}{12}$  to 25 inches/min. longitudinal and cross,  $\frac{1}{2}$  to  $12\frac{1}{2}$  inches/min. vertical. Power rapid traverse, all directions. Table travel  $33\frac{1}{2}$ " long., 10" cross, 18" vertical.

#### CONTROLS

Single adjustable START-STOP-BRAKE lever. Dial selection of speeds and feeds (U.S. inch calibrated) with single lever controls. Magnetic motor starter.

FOR INFORMATION, CATALOGS, AND REFERENCE DATA, WRITE

**austin**

INDUSTRIAL CORPORATION

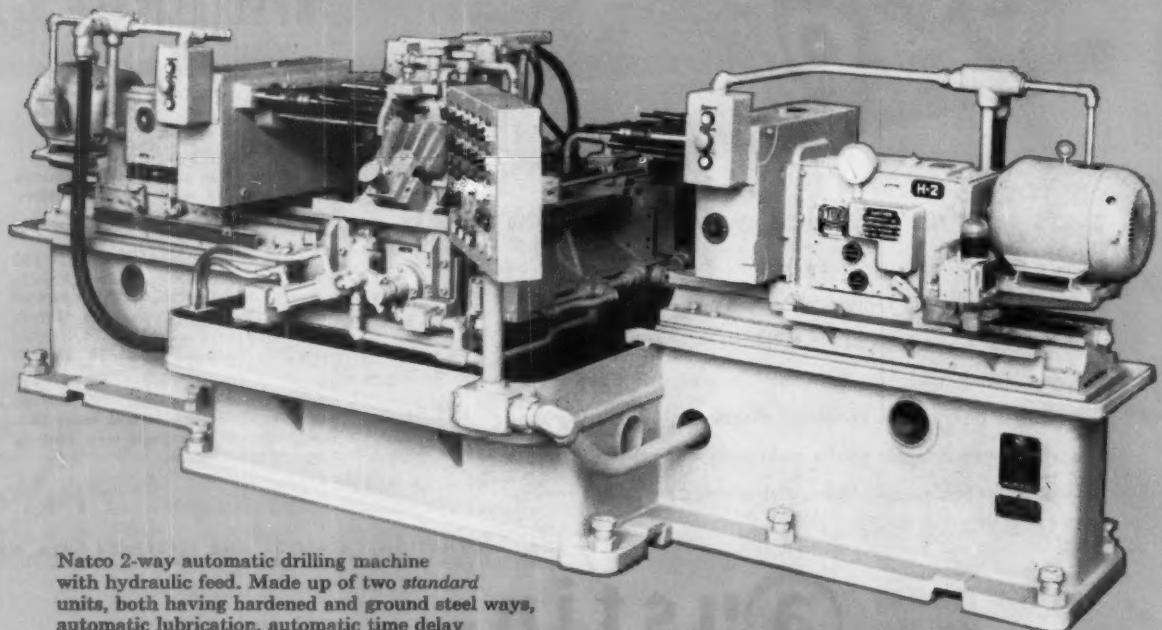
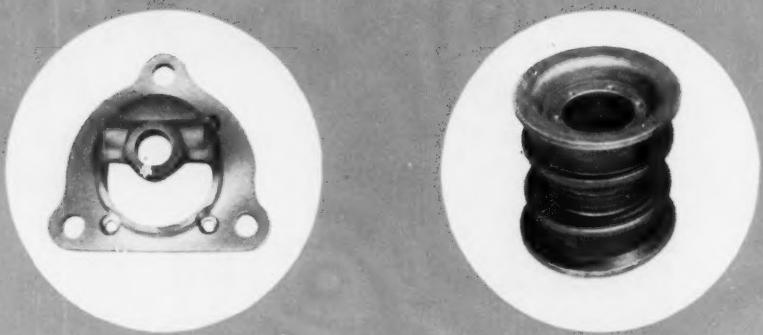
76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL... YOUR FULL GUARANTEE OF SATISFACTION

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—45

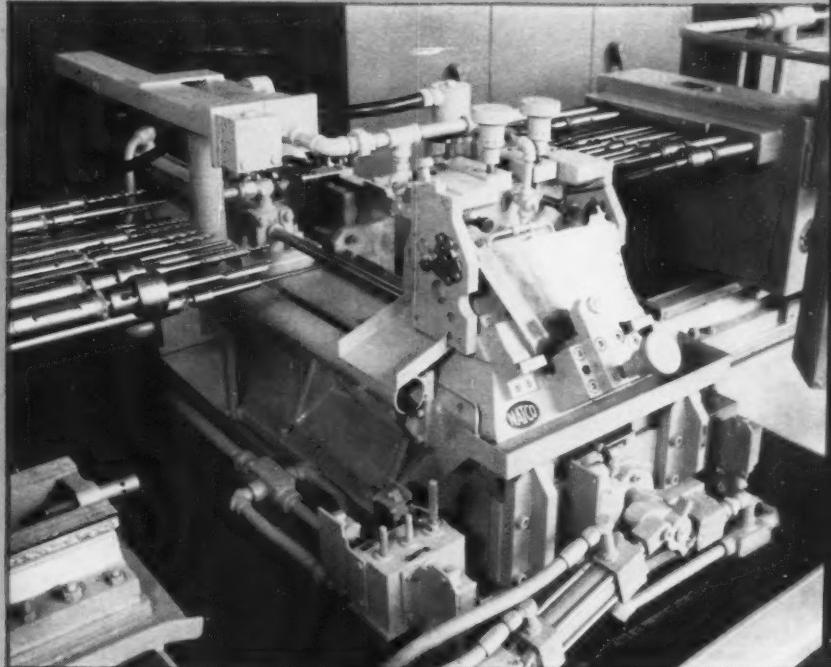
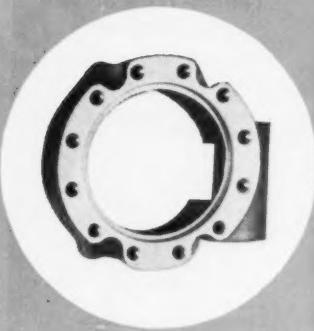
# Natco Standard Units Perform Special Jobs



Natco 2-way automatic drilling machine  
with hydraulic feed. Made up of two standard  
units, both having hardened and ground steel ways,  
automatic lubrication, automatic time delay  
and positive stop.

Many special jobs can become routine with Natco's *standard* unit design. Take these parts, for instance. Unique parts presenting unique problems. Natco solved them by using *standard* horizontal, self-contained Holeunits with automatic fixtures. Varied operations are performed—production to meet customer's requirements.

Natco's use of *standard* units can mean quicker delivery and lower price to you. Call a Natco Field Engineer to determine whether Natco's *standard* unit design can solve your "special" problems.



*Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.*

### NATIONAL AUTOMATIC TOOL COMPANY, INC.

*Richmond, Indiana*

Multiple-spindle drilling, boring,  
facing and tapping machines.  
Special machines for automatic  
production.

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston,  
Philadelphia, Cleveland and Los Angeles; distributors in other cities.



# From coast to coast there's no grinding wheel service like Norton...

for your General Purpose Grinding  
or your High Production Jobs



## Norton Nation-Wide Service Is Complete

Your Norton Distributor is one of over 315 in the United States. His men are trained to help you in grinding techniques and wheel selection. Also, he's ready to call in a Norton Abrasive Engineer for expert aid in any of your complicated grinding problems. His sizable grinding wheel stocks are fitted to the needs of his area — and they're backed by the world's largest stock, located in five Norton warehouses, as well as at Norton's Worcester headquarters. Norton manufactures grinding wheels on both coasts, at Worcester, Mass. and Santa Clara, California.

### Get These Facts and Prices

The new catalog *Norton Grinding Wheels*, Form 1052, brings you a lot of general purpose information and describes wheel specifications that will bring you best results. Every item in this catalog is available from stock. Included is a new supplement showing net prices. Get one from your Norton Distributor. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. Export: Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. For the booklets or other information write to Norton Company, Worcester 6, Mass.



W-1766



### Norton Wheels Meet Every Possible Need

Norton makes a really complete line of grinding wheels to save you time and money across the widest range of grinding jobs . . . adding the same profit-boosting "Touch of Gold" to your general purpose grinding as to your production jobs. Norton wheels are made in every abrasive-and-bond combination you need, including the new, revolutionary 44 ALUNDUM\* abrasive that's tops among all non-premium priced aluminum oxide abrasives.

\*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

**NORTON**  
ABRASIVES

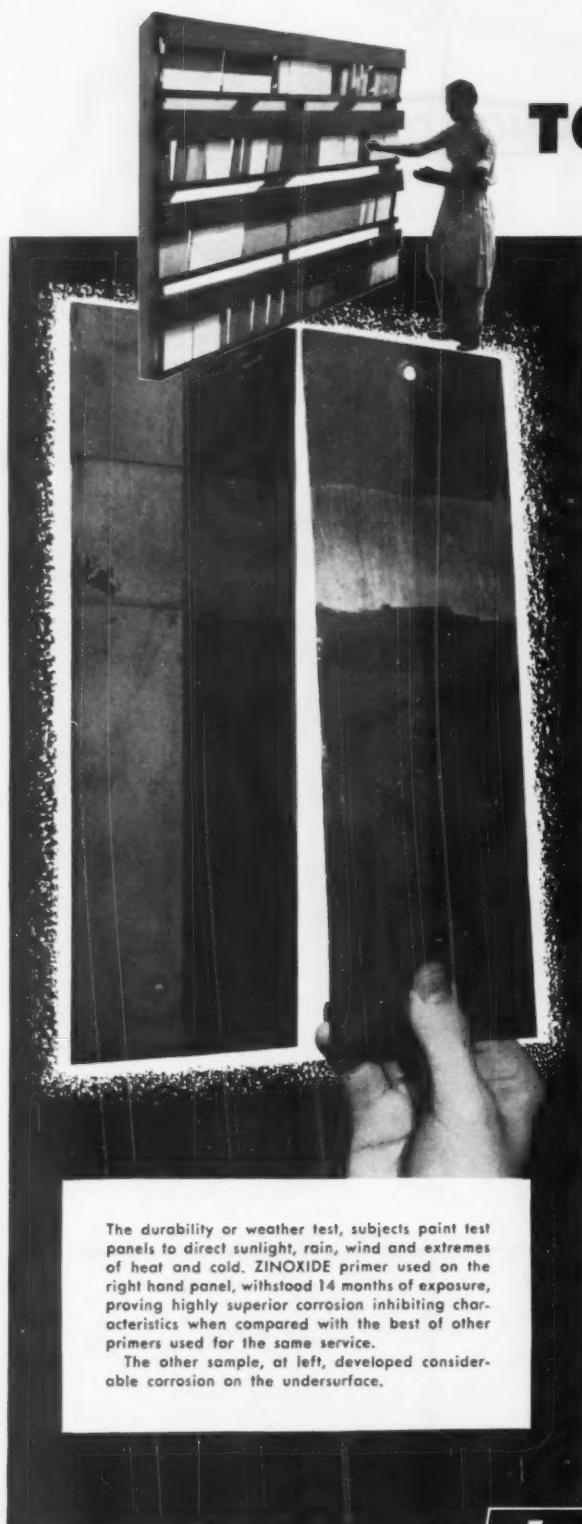
*Making better products  
... to make  
your products better*

#### NORTON PRODUCTS:

Abrasives • Grinding Wheels  
Grinding Machines • Refractories

#### BEHR-MANNING PRODUCTS:

Coated Abrasives  
Sharpening Stones • Behr-cat Tapes



The durability or weather test, subjects paint test panels to direct sunlight, rain, wind and extremes of heat and cold. ZINOXIDE primer used on the right hand panel, withstood 14 months of exposure, proving highly superior corrosion inhibiting characteristics when compared with the best of other primers used for the same service.

The other sample, at left, developed considerable corrosion on the undersurface.

## TORTURE RACK for finishes

*...helps improve  
industrial primers*

The old saying, "proof of the pudding is in the eating" describes the durability tests employed at Lowe Brothers. Conditions closely duplicating those in actual service are a vital part of testing all new finishes as well as the continual improvement of existing products.

A recent product development program carried out by our Technical Department is a good example.

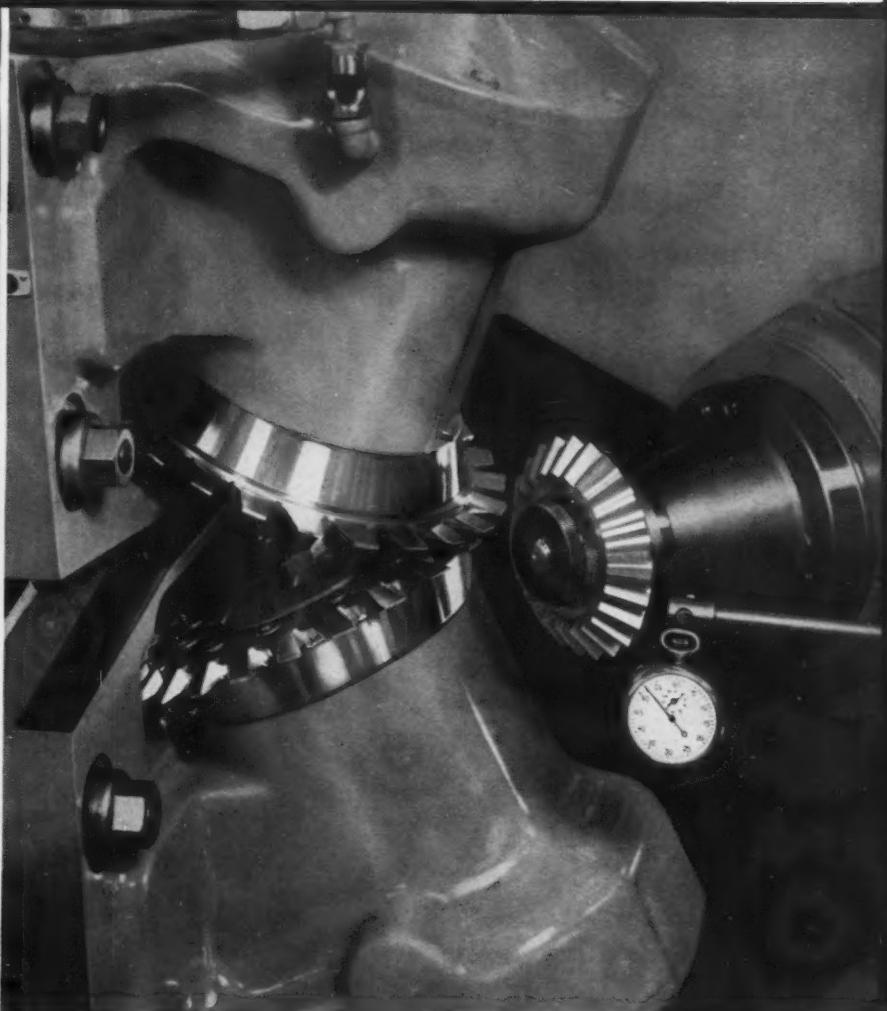
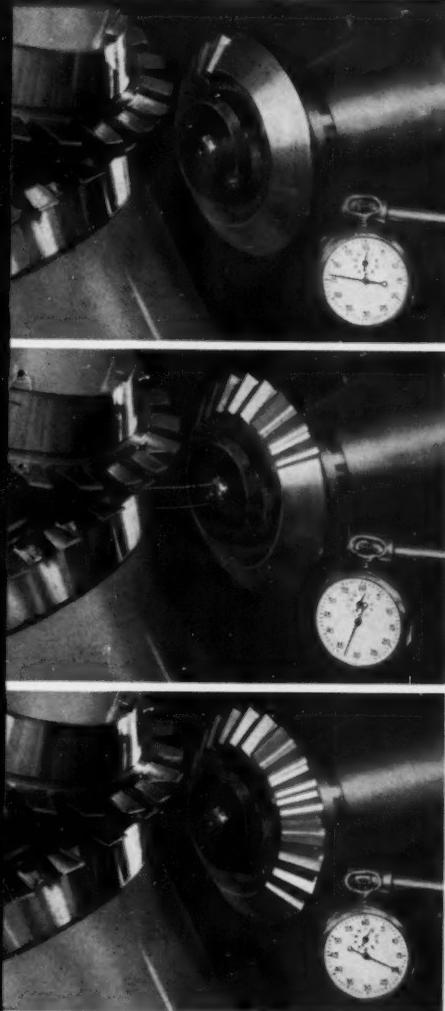
Extensive tests were made on many types of pigment materials to develop a superior industrial primer. The result—ZINOXIDE—a primer with highly superior corrosion inhibiting properties ideal for the surface protection of forgings, castings and sheet steel products.

For the best industrial finishes, call or write Lowe Brothers, 424 East Third Street, Dayton 2, Ohio

**LOWE BROTHERS**

**INDUSTRIAL FINISHES**

also Style-Tested  paints for the home



## 3 minutes-52 seconds, completed from the solid You can cut gears 5 times faster!

You can increase production by as much as 400%.

Your exact gain may vary with different gears, but in most cases this new generator will complete five gears in the time earlier models cut just one. The illustrations above show a 6 DP, 25 tooth,  $\frac{7}{8}$ " face width, straight bevel gear completed from the solid blank.

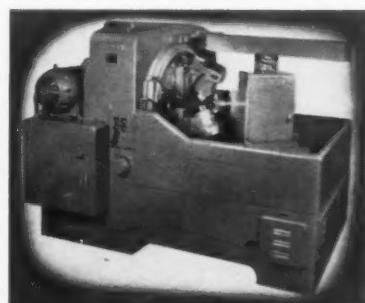
The No. 104 Straight Bevel Coniflex\* Generator completes each tooth in one rapid operation. A pair of

\*Coniflex® straight bevel gears with localized tooth bearings.

multi-blade disc-type cutters combined with a cam-controlled machine cycle insures high efficiency, fine finish and maximum cutter life.

Easy to set up, the No. 104 has a wide range of capacity. You'll get the same excellent results for both small quantity jobbing work and volume production.

To discover other savings you can make with this remarkable Gleason Generator, simply write for descriptive bulletin.



*The Gleason No. 104 Straight Bevel Coniflex Generator cuts gears up to  $8\frac{1}{2}$ " diameter,  $4\frac{1}{2}$ " cone distance and  $1\frac{3}{8}$ " face width, from 20 to 3 DP, ratios up to 10 to 1.*

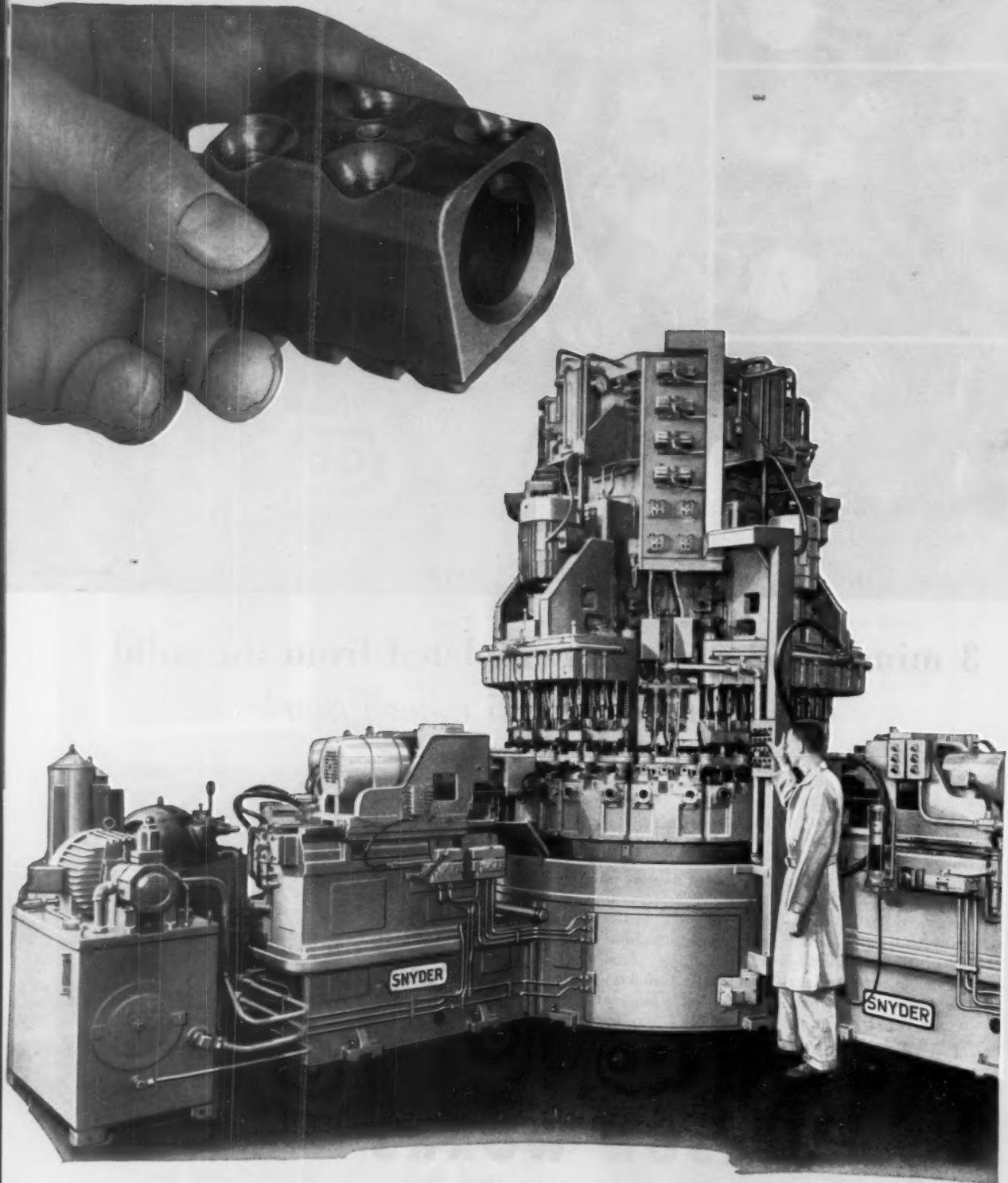


# GLEASON WORKS

*Builders of bevel gear machinery for over 90 years*

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

# **Simplified Automation in Successfully Applied in New**



# Machining Small Parts is Snyder Center Column Machine

The principle of automation is inherent in the design of this machine which performs, in its continuous 16-station cycle, 25 operations equalling the performance of two or three ordinary machines. The workpiece is a small automotive steering gear ball nut  $2\frac{1}{2}'' \times 1\frac{5}{8}'' \times 1\frac{1}{8}''$ . Production is 331 pieces per hour.

Three workpieces are loaded and automatically clamped in each of the 16 fixtures on the 96" index table. A unique feature of the machine is its special heavy-duty cast iron center column 108" high and 48" in diameter. This massive column is necessary to withstand the high vertical thrust loads imposed by six heads

mounting 9 spindles each which drill, flat bottom drill and radius chamfer four recirculating ball holes and tap drill and chamfer one hole in the same part face.

The table is also designed to withstand high horizontal thrust loads for core drilling, chamfering and reaming the threaded shaft hole which requires three spindles for each of the seven Snyder heavy-duty way type units.

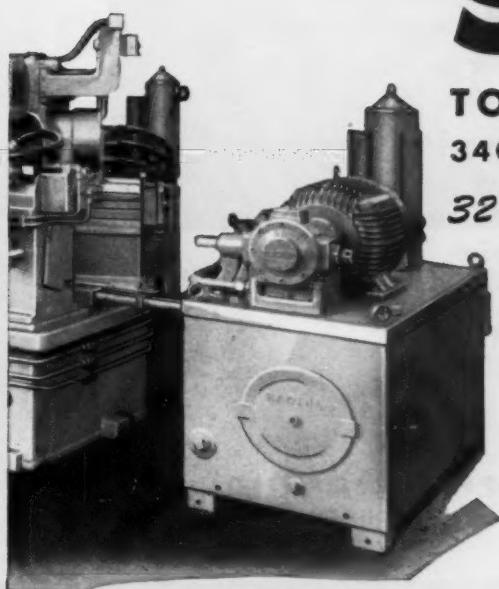
The machine, one of the largest of its type, weighs 50,000 lbs., requires 288" x 312" floor space and stands 156" high overall.

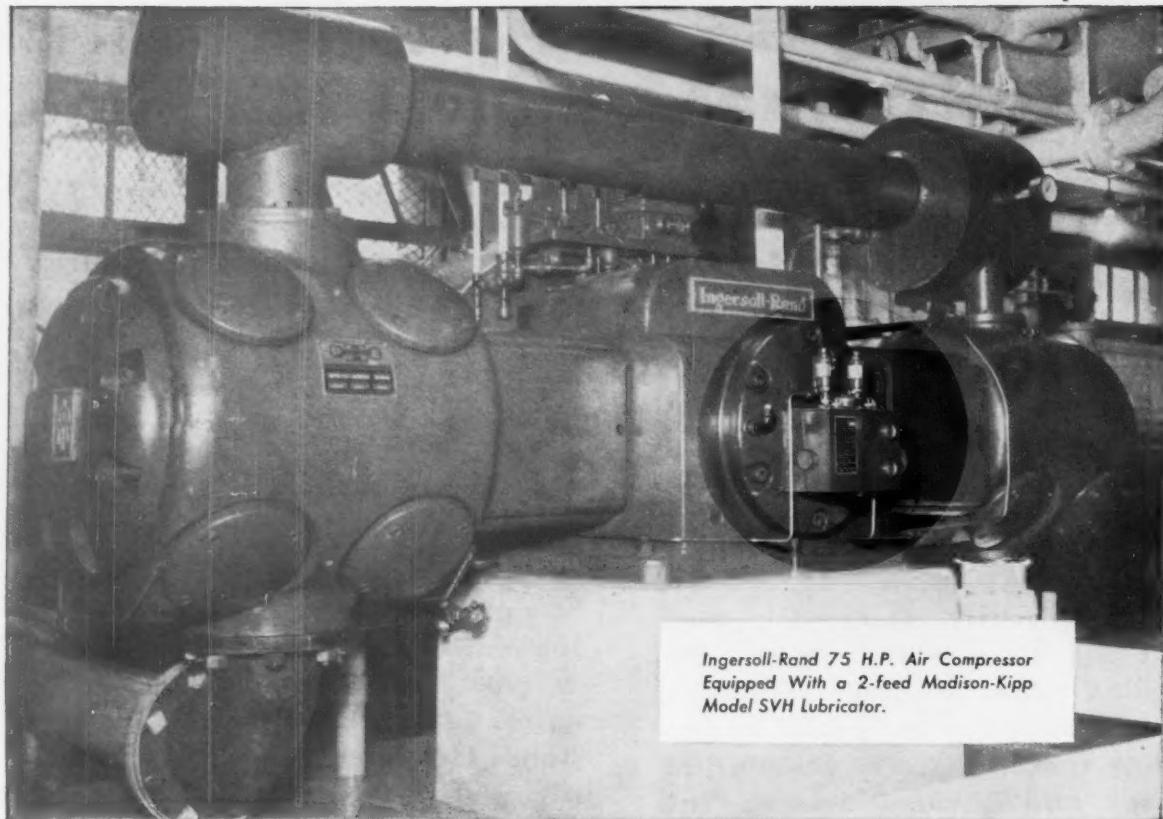
If you have an automation problem in machining small parts, this type of Snyder machine may be the right answer.

# SNYDER

TOOL & ENGINEERING COMPANY  
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

*32 Years of Special Machine Tools with Automation*





Ingersoll-Rand 75 H.P. Air Compressor  
Equipped With a 2-feed Madison-Kipp  
Model SVH Lubricator.

**Machines of great performance use the most  
dependable oiling system ever developed**

**MADISON-KIPP**

*Fresh Oil*

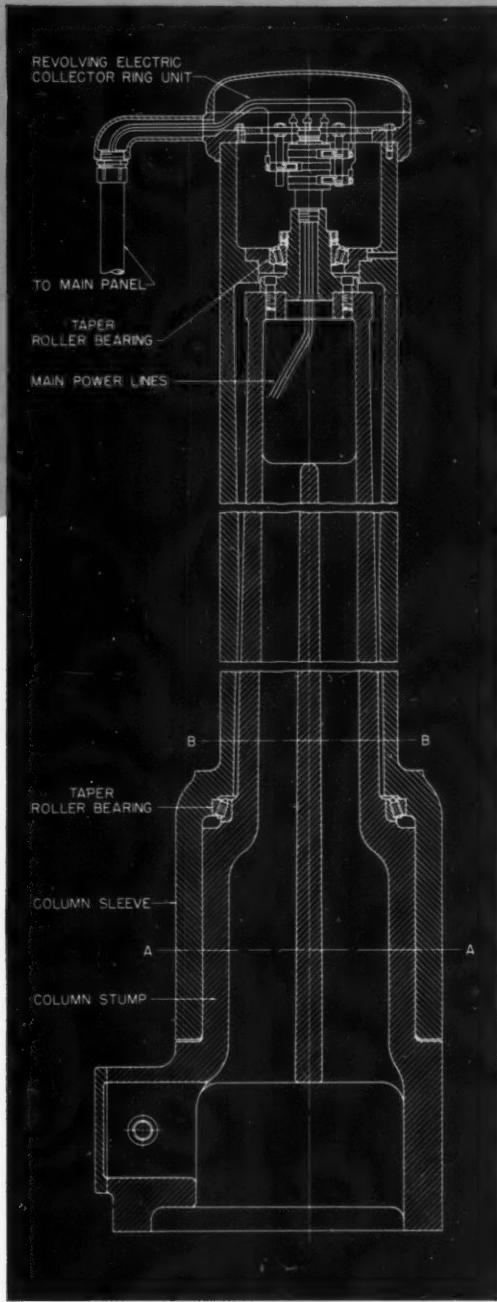
... by the measured drop,  
from a Madison-Kipp Lubricator is the most dependable method of  
lubrication ever developed. It is applied as original  
equipment on America's finest machine tools, work engines  
and compressors. You will definitely increase your  
production potential for years to come by specifying  
Madison-Kipp on all new machines you buy, where oil under  
pressure fed drop by drop can be installed. There are  
6 models to meet almost every installation requirement.



**kipp**

**MADISON-KIPP CORPORATION**  
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

- Skilled in Die Casting Mechanics
- Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools



New thrust resistant, "TIMKEN" mounted column and sleeve assembly.

Write for Bulletin No. 328 for the complete story of More and Better Work at Lower Cost.

# Rigidity Increased

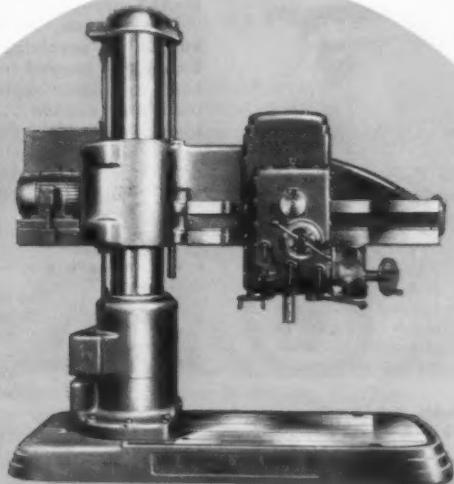
**50%**

The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

Large Timken bearings at top and bottom when pre-loaded bind the column and sleeve into the equivalent of a solid unit for resisting functional stresses and cuts arm deflection to an absolute minimum. This definitely results in greater accuracy and longer cutting tool life. To further increase resistance to stresses the column sleeve departs from conventional design by employing a tapered inner wall providing an unusually heavy section where the greatest functional stresses are concentrated.

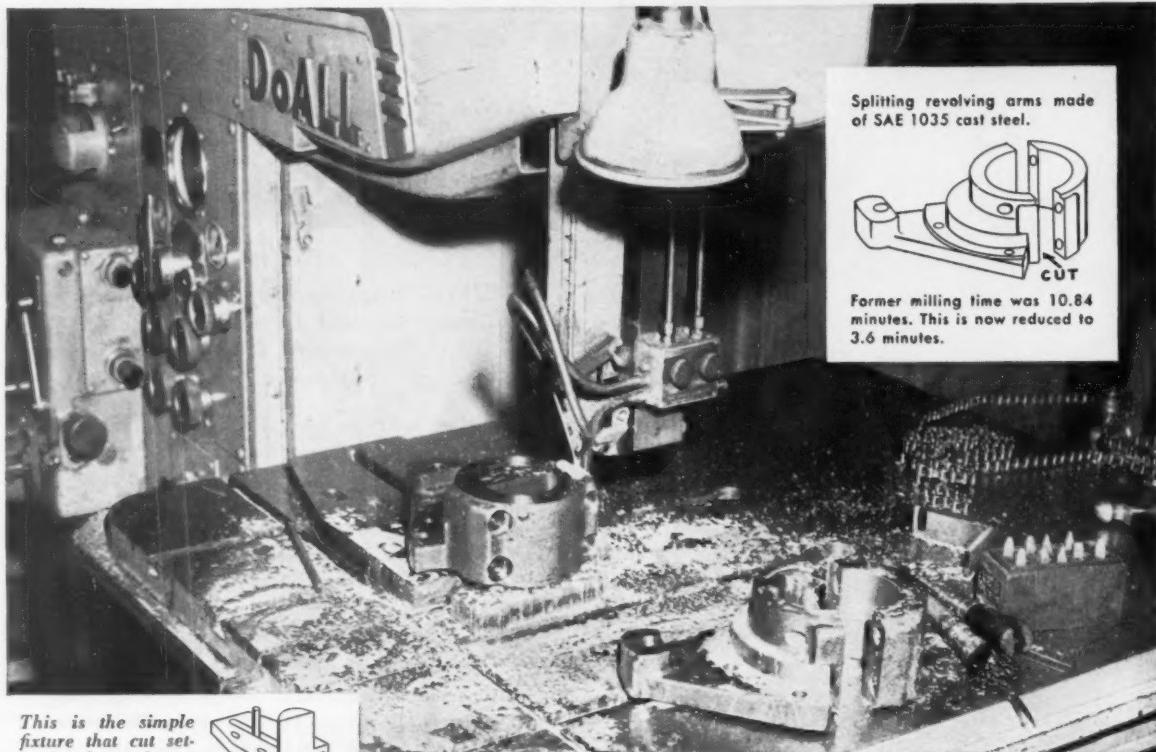
A new "NON-CREEP" clamping mechanism in combination with a solid column sleeve cuff adds greatly to the rigidity of this new "AMERICAN" Radial.



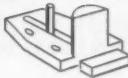
**THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U.S.A.**

LATHES AND RADIAL DRILLS

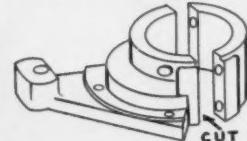
# How Production Band Machining Cuts Splitting Costs



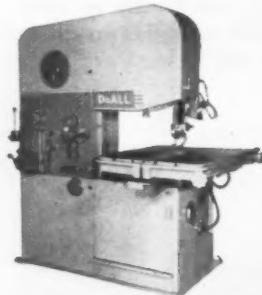
This is the simple fixture that cut set-up time from minutes to seconds.



Splitting revolving arms made of SAE 1035 cast steel.



Former milling time was 10.84 minutes. This is now reduced to 3.6 minutes.



This is the Contour-matic which doubled production with a carbon steel blade.

**O**This is the Demon H.S.S. blade that boosted production 3 times greater than originally done on a milling machine.

Friendly DoALL Sales-Service Stores in 38 cities—call yours today!



\*\*\*\*\*

**FREE LITERATURE AND MOVIES**—The new 16-page saw band catalog and the new contour-matic catalog are now available as well as two sound-color movies for group showings—"Production Band Machining" (30 min.), and "Production Tooling" (10 min.).

**Call Your DoALL Service-Store**

**MACHINING TOOLS** ..... **CUTTING TOOLS** ..... **MEASURING INSTRUMENTS** ..... **SHOP SUPPLIES** ..... **IN STOCK**

# BRASS

keeps sales up...

manufacturing costs down

**TURNER IS A LONG-TIME USER OF  
ANACONDA BRASS ROD AND TUBE—  
GIVES 10 REASONS WHY—**

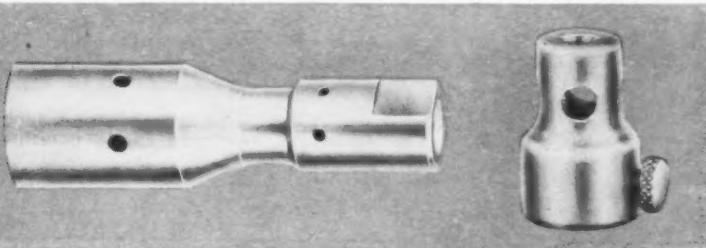
Blow torches built by The Turner Brass Works, Sycamore, Ill., have a reputation for dependable operation and long life. Since 1871, brass has been used consistently in their construction and has built a quality reputation for Turner. Turner prefers Anaconda Brass as a quality metal and looks to The American Brass Company as a quality source of supply.

5673

These are the reasons given:

- ① Brass is the quality material needed for the service.
- ② Brass is easily machined at high speed, with less tool breakage—manufacturing costs are 15% lower than with other metals.
- ③ Close tolerances are easily held with brass.
- ④ Threading holds well—yet accessories are easily screwed on and off.
- ⑤ Brass takes a good finish—polishing is easy and economical.
- ⑥ Clean, polished brass products have proven high sales appeal.
- ⑦ Brass stands up under alternate heating and cooling.
- ⑧ Brass resists corrosion—the torches are used on land and sea, throughout the world.
- ⑨ Brass gives superior wear on valve seats.
- ⑩ Brass has high public acceptance as a quality material.

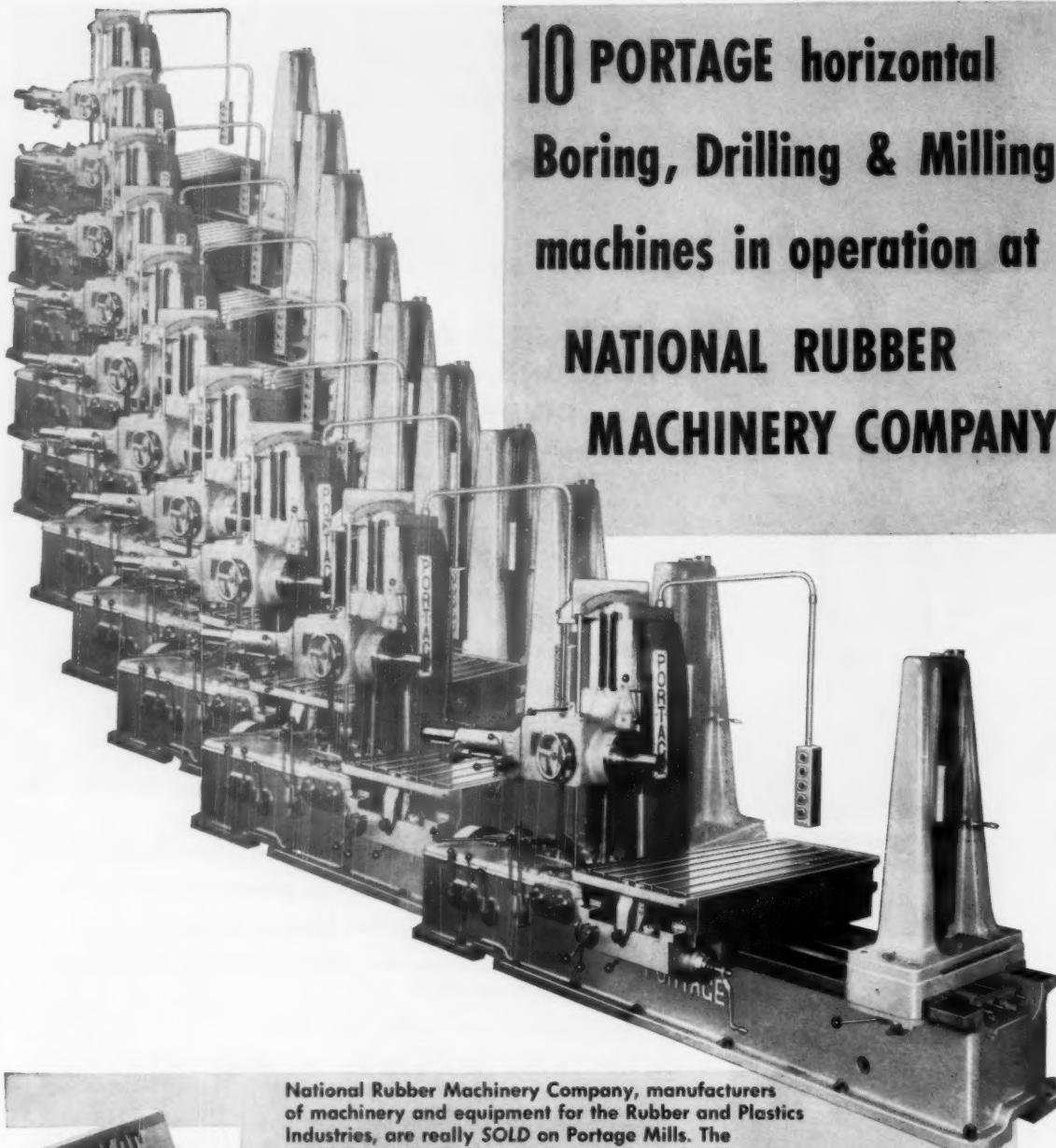
Turner liquefied petroleum torch No. LP-555, with disposable fuel tank. Below are accessories of brass—holder for soldering tip and a heavy-duty burner.



*The American Brass Company, Waterbury 20, Conn.  
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

**ANACONDA®**

**COPPER • BRASS • BRONZE**



**10 PORTAGE horizontal  
Boring, Drilling & Milling  
machines in operation at**

**NATIONAL RUBBER  
MACHINERY COMPANY**

National Rubber Machinery Company, manufacturers of machinery and equipment for the Rubber and Plastics Industries, are really SOLD on Portage Mills. The excellent service of these mills are reported by the plant managers at Columbiana, Ohio and the Akron Division plant. This large installation certainly represents a vote of confidence for the performance of Portage Mills . . . and speaking of confidence . . . many leading manufacturers have come to realize that the ruggedness, versatility and low maintenance cost of Portage Mills makes them the best buy . . . and remember . . . their initial capital investment cost is less, without the sacrifice of quality. Write for complete information . . . TODAY.



THE *Portage* MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

THE **ULTIMATE**

IN

**BEVEL  
GEAR  
ACCURACY**



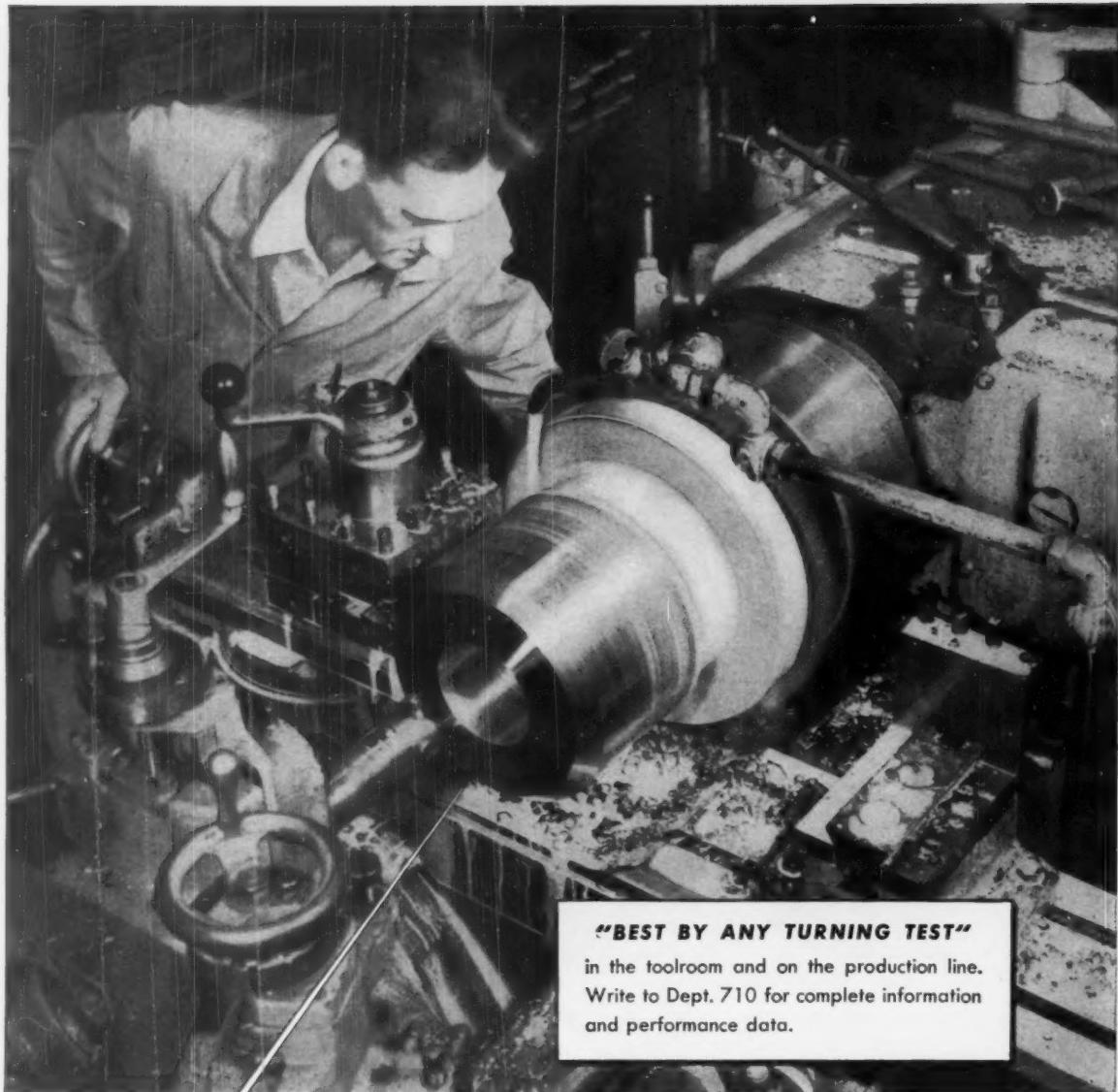
- low-cost tooling
- simplicity of set-up

NO. **120**  
**MIKRON**

*fine pitch*  
**BEVEL GEAR  
HOBBING MACHINE**

**RUSSELL, HOLBROOK & HENDERSON, INC.**

292 Madison Avenue, New York 17, N. Y.



**"BEST BY ANY TURNING TEST"**

in the toolroom and on the production line.  
Write to Dept. 710 for complete information  
and performance data.

Jones & Lamson turret lathes are **BUILT** and  
**POWERED TO PRODUCE**  
**MORE CHIPS per tool**  
**MORE PIECES per hour**  
**MORE PROFIT per job . . . than any turret lathe of comparable size!**

# JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vt., U.S.A.



the man who needs a new machine tool  
is already paying for it

MACHINE TOOL DIV.

**TOUGH**  
and Flexible . . . the  
combination that  
means Longer Life,  
Lower Costs!

**HARD EDGE**  
**HIGH SPEED Tungsten**  
**12"-18T**

**SIMONDS**  
“Red End”  
**HACKSAW BLADES**  
(Hard Edge)

**BEND 'EM**

**TWIST 'EM**

**KINK 'EM**

**STEP ON 'EM**

Ask for a Twister Demonstration, or better yet, try a "Red End" Blade yourself.

**For Fast Service from Complete Stocks Call your**

**SIMONDS Industrial Supply DISTRIBUTOR**

**SIMONDS SAW AND STEEL CO.**  
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon  
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.  
Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—61



**For men who know  
drill heads best, it's  
always U. S. Drill Head  
...5 to 1**

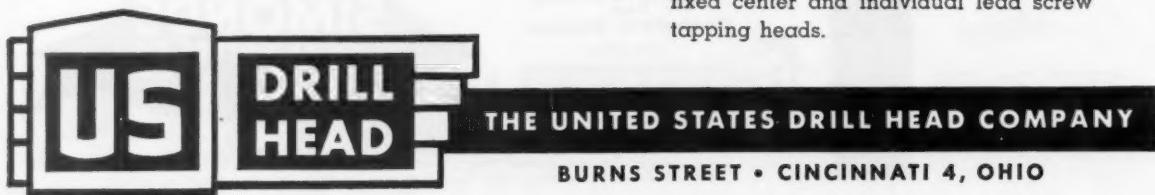
The U. S. Drill Head Company's first Fixed Center Drill Head was produced for Borg and Beck, of Chicago — a subsidiary of Borg-Warner.

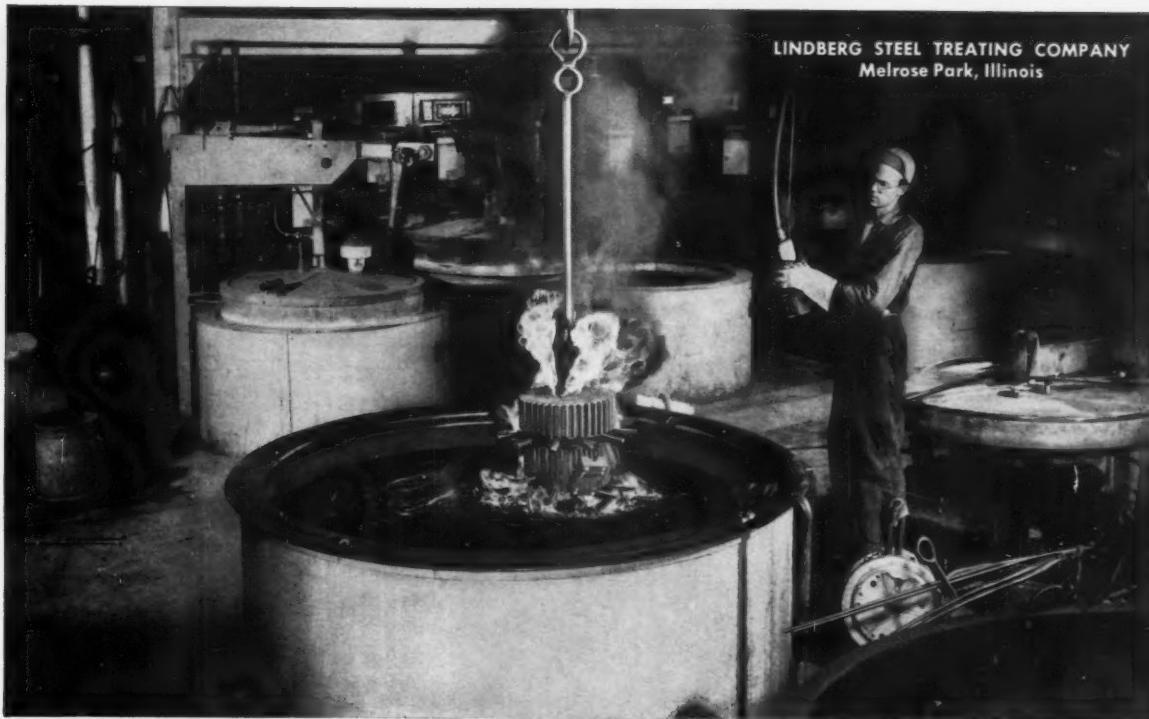
**1957**

The 50,000th Head was shipped.

Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

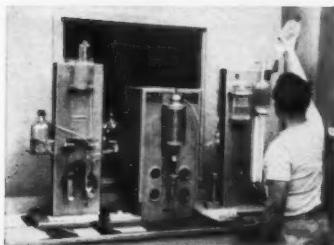
Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.





LINDBERG STEEL TREATING COMPANY  
Melrose Park, Illinois

## For machine shop tolerances— Lindberg uses Cities Service Quenching Oil



**Lindberg's Lab** stringently tests treated metals. Dimensional changes from poor quenching oil would quickly show up here. But Cities Service Quenching Oil cools metal with no significant dimensional change.



**Some of Lindberg's Furnaces.** Here, they heat-treat all kinds of steel products . . . bolts, washers, gear blanks, saw blade segments, etc. Steel for bars of Illinois State Penitentiary was one of their first jobs.

At Lindberg Steel Treating Company a routine order might include a dozen shafts, stamping and forming dies, jigs and fixtures and even production parts. But though the products might differ, most would carry the same stipulation—heat treat with very low dimensional change.

To some heat treating operations this might present a problem, but not to Lindberg. By the use of Cities Service Quenching Oil, they're able to cool their steel with no significant changes in dimension.

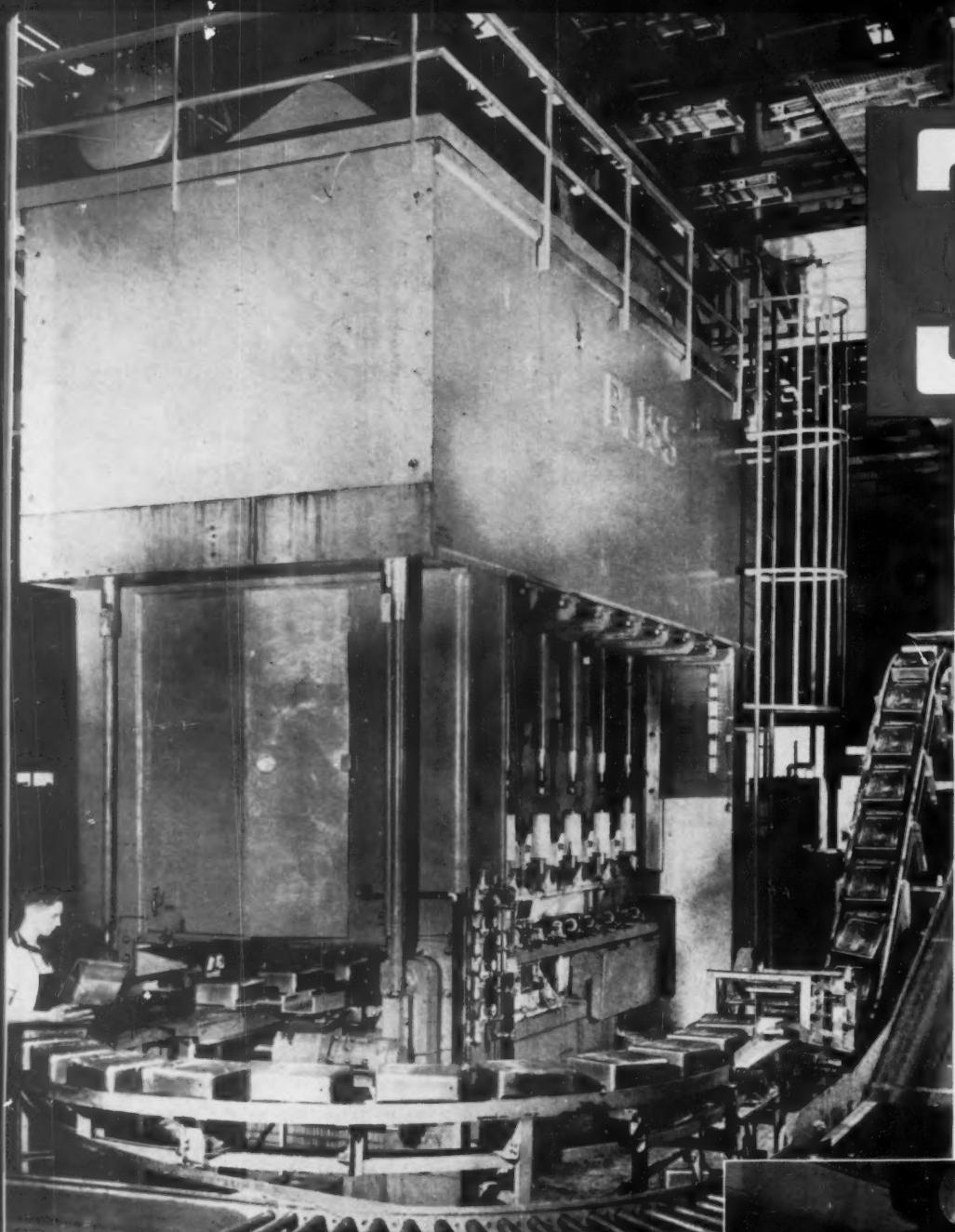
"In addition," say Lindberg metallurgists, "we like Cities Service Quenching Oil because it has high flash point, consistent viscosity, excellent oxidation resistance, and a stable cooling rate."

Anyone looking for a better quenching oil would do well to try this superior Cities Service oil. For further information, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

# CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

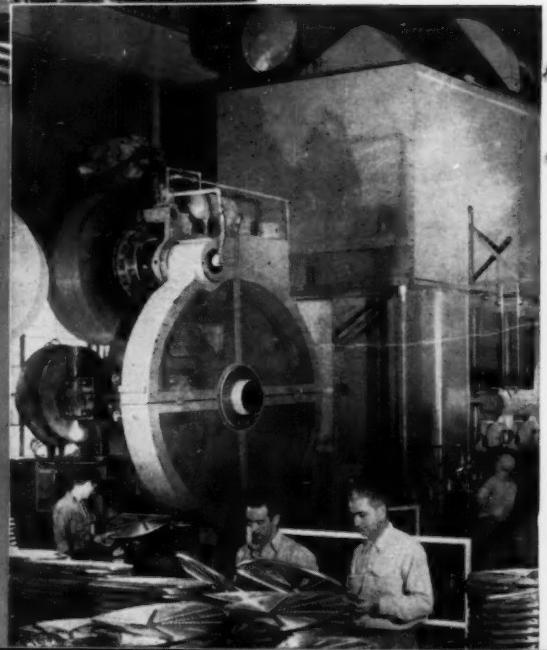
# 3



**THIS ONE MAKES PANS . . .** Pans are produced at the rate of ten a minute in this 700-ton seven-station Bliss transfer feed press. A 22" x 24" blank is drawn 5½" deep in the first station; trimming, piercing and restriking operations follow. Pans leave the press completely finished — ready for pickling and enameling.



**THESE TWO MAKE SHELVES . . .** "Lazy Suzan" shelves by the millions are the product of these two 800-ton Bliss transfer feed presses and the two Bliss embossing presses stationed at their output ends. Coil stock is blanked in the first stations of the presses and work pieces carry through the remaining five stations and into the embossing press automatically. Each press produces 15 shelves per minute through two shifts.



# BLISS TRANSFER FEED PRESSES STEP UP GE REFRIGERATOR PRODUCTION

*They make all the pans and all the shelves GE needs for its annual output of more than half a million refrigerators!*

Here's what's happening at Appliance Park: 6000-pound coils of steel feed into one end of these Bliss transfer feed presses, lines of shelves and pans march out the other ends, and only a few attendants stand by in between.

Three separate press lines are involved. One is a 700-ton, seven-station press (with coil cradle, straightener and roll feed) that produces ten deep-drawn pans a minute.

The other two — identical set-ups — are 800-ton, six-station presses, also with cradle, straightener and feed, which feed into 800-ton embossing presses (see photo). Each produces shelves at the rate of 15 per minute.

The method of operation is the same for all. Mill coils are loaded on the cradle. From there, strip feeds through the straightener and into the roll feed.

At the first die station in the press a blank is cut off. The transfer feed fingers move in on the work piece and carry it to the next station. As the slide comes down, the fingers move out; as it rises, they move in and repeat the cycle. New strip is brought to the first station and a completed part delivered with every stroke of the press.

This set-up has solved a number of knotty problems for General Electric. Previously production required the services of two or three vendors, doubling and tripling the cost of dies and labor. Still further savings have come from the use of standard mill coils instead of blanks. In fact, the savings are expected to bring about an early amortization of the entire installation.

Bliss has been building transfer feed presses and systems like this since

Spanish-American War days; today, over a thousand are in use. If you're faced with long-run production problems, let a Bliss engineer show you some typical uses of the transfer feed principle. Perhaps it can pull your production costs into line — as it has for so many others.

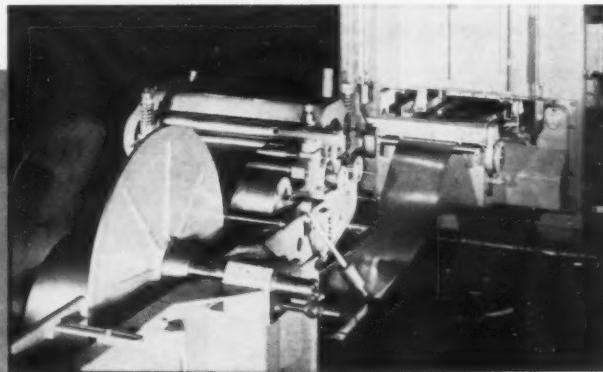
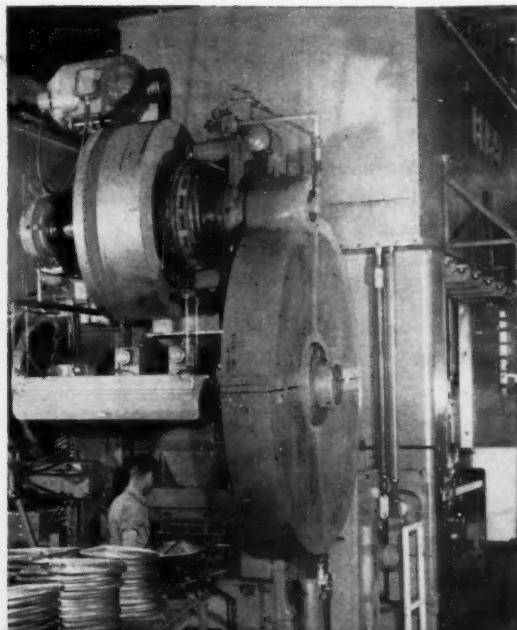
**SEE IT IN ACTION . . .** A new color-and-sound movie takes viewers to the plant, shows the press in action. See close-ups of tooling, of transfer fingers, of coil feed techniques. To arrange a showing at your plant, write to E. W. Bliss Company, Canton, Ohio, or see your local Bliss representative.



E. W. BLISS Company, Canton, Ohio  
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

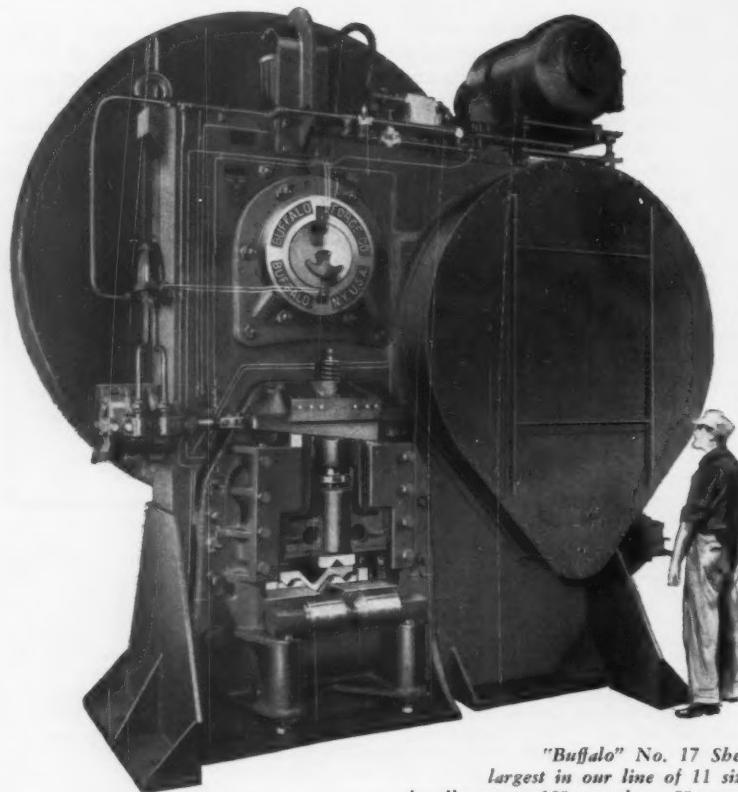
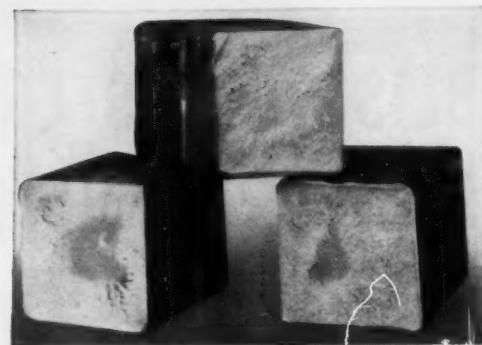
*is more than a name...it's a guarantee*

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, Calif. Branch Offices in Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. Other representatives throughout the world.



**ALL THREE LINES WORK FROM COIL STOCK . . .** A number of handling operations are eliminated because, on each of the three presses, strip from standard-sized mill coils are fed from this power coil cradle through a five-roll straightener and into the roll feed on the press. Blank is cut off in the first die station of the press. Though not shown here, a second coil is ordinarily held ready at the rear of the cradle to speed handling. Bliss engineers designed all the coil handling equipment and all of the tooling for each of the presses.

# CLEAN-CUT BILLETS FOR BETTER FORGINGS AT LOWER COST



"Buffalo" No. 17 Shear,  
largest in our line of 11 sizes,  
handles up to 10" rounds or 9" squares  
at 6 strokes per minute. There's a "Buffalo" Shear for your operation!

**"BUFFALO" BILLET SHEARS** not only cut your forging stock to length squarely and accurately at production speeds, but result in better preparation of the stock.

clutches, counterbalance and hold-down — that assure you many years of profitable service with almost negligible maintenance. Write today for Bulletin 3295-C for all details.

\*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



**BUFFALO FORGE COMPANY**

440 BROADWAY

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING

PUNCHING

SHEARING

BENDING



# Now . . . available in 6 models

in both regular and non-magnetic types

The amazing *New*

CHECK  
MASTER

## TEST INDICATOR

THAT RESPONDS TO DIMENSIONAL VARIATIONS OF  
.000020" . . . AND REPEATS WITHOUT VISIBLE ERROR



Model 32  
Graduated .0005"  
Range .016"



Model 34  
Graduated .0001"  
Range .006"



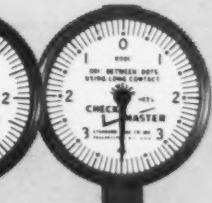
Model 21  
Graduated .001"  
Range .016"



Model 22  
Graduated .0005"  
Range .016"



Model 24  
Graduated .0001"  
Range .006"



ALL  
DIALS  
SHOWN  
ACTUAL  
SIZE



**STANDARD**

- for . . . use on all types of fixtures.  
. . . surface plate set-ups.  
. . . truing of pieces on machines.

They're here! Six . . . new Check Master test indicators, incorporating all the advance-engineered features you asked for.

To mention a few . . .

High sensitivity that responds to dimensional variations of .000020" — coupled with the ability to repeat without visible error.

All bearings jeweled for longer service life.

Ease of repair and maintenance — only 3 moving parts.

\*An All-Purpose Model that gives you both a .0001" and a .001" indicator — in a single instrument — simply by changing the contact point.

Model 25  
All-Purpose\*  
(Shown with long,  
contact point.)

Write for descriptive bulletin — or better still, talk to your Man from Standard about your specific Check Master requirements.

Available in both regular and non-magnetic models, with 1½" or 1¾" dials. Graduated in .0001", .0005" or .001", with a range of .008" or .016".



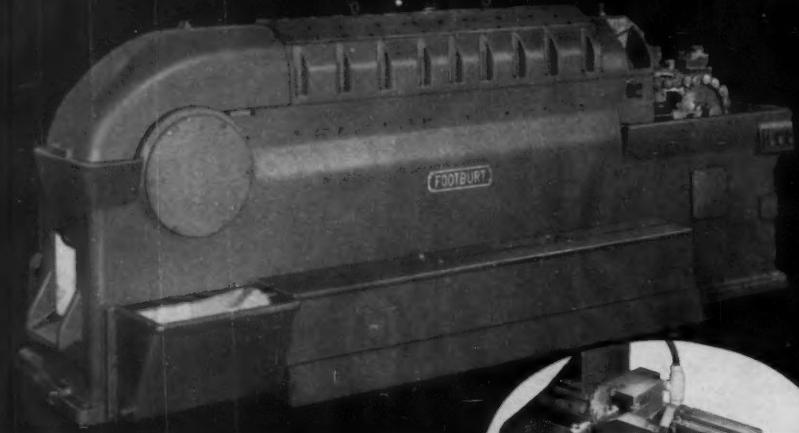
**STANDARD** Gage Company, Inc.

SINCE 1925 152 Parker Avenue • Poughkeepsie, New York

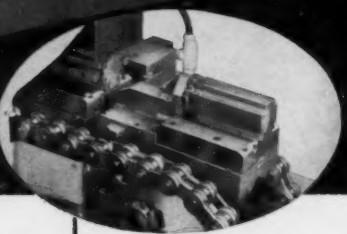
A complete line of Indicating . . . Fixed and Adjustable Limit Gages



Continuous Type  
Broaching Machine  
Built in Five Sizes



Holding Fixtures are designed  
for quick, convenient loading,  
with automatic clamping,  
unclamping and unloading.



**machining connecting rods  
and caps an opportunity for**

# *Surface Broaching*

■ Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footbur Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

**THE FOOTE-BURT COMPANY**

Cleveland 8, Ohio • Detroit Office: General Motors Building



# **F O O T B U R T**

**PIONEERS IN SURFACE BROACHING**



BODY      RAKE      BACK TAPER  
TRUNCATION      POINT

**Chamfer**

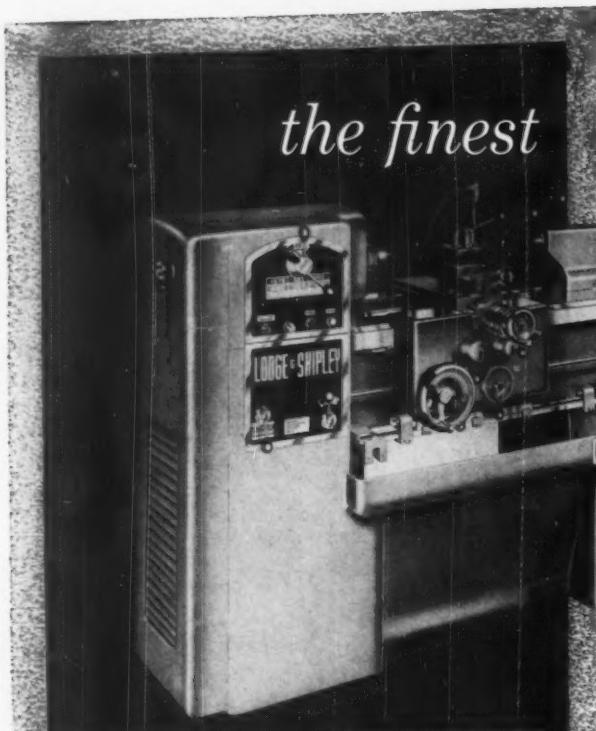
FLUTES      RELIEF      SHANK  
SQUARE      CONCENTRICITY      THREADS

Chamfer "run out" in a tap is the deviation in chamfered thread height from one land to another in relation to the axis. If present to an appreciable degree, this eccentric condition affects hole size and may cause bell mouth in threaded holes and rapid wear on the cutting teeth of taps.

Inspection of chamfers, enormously magnified, is another of the careful quality control checks at "Greenfield" which assure that the taps you buy are as free from faults as constant vigilance can make them.

IF IT CAN BE MEASURED **GREENFIELD** MEASURES IT

**GREENFIELD** TAP and DIE CORP.  
GREENFIELD, MASS.



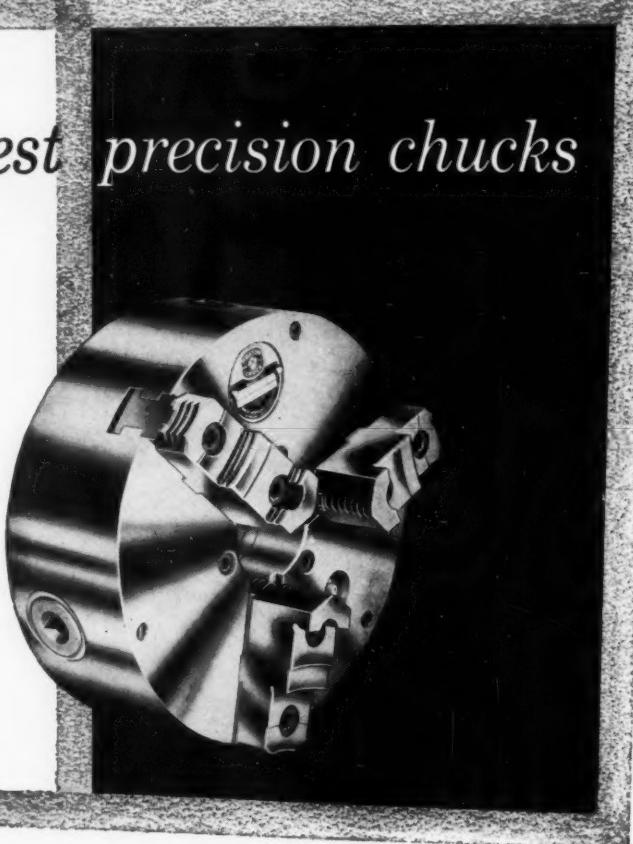
## *the finest high speed lathes*

Photo courtesy  
Lodge & Shipley

This is the NEW Lodge & Shipley 10" Hi-Turn Lathe which joins the line famous for lathe leadership. It provides high speed turning, boring and facing capacity for production departments. For complete information, write for Bulletin 300, The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

## *deserve the finest precision chucks*

This is Horton's 3-Jaw Scroll Universal Chuck which for over 100 years has been the ideal complement to the world's finest tool room, general purpose and production lathes. Its precision and lasting accuracy make it a part of any production picture. For the complete story on this and Horton's complete line of precision chucks, see the Horton people in your area now.



HORTON CHUCK DIVISION  
GREENFIELD TAP AND DIE CORPORATION  
WINDSOR LOCKS, CONN.

**"Re-investment in a replacement program is, in our opinion, vital to successful growth"**



**"Gregory Industries, Inc. manufactures Nelson stud welding equipment and patented granular flux-filled studs which are automatically end welded to metal with the stud welding gun. Employed to hang, handle or hold, Nelson studs are used extensively in the metalworking and construction fields to reduce costs, speed production and improve product quality."**

**"Although our company is young and comparatively small, it is growing rapidly. Since its beginning we have recognized the need for a sound equipment replacement program and have consistently ploughed back a substantial part of our earnings for new equipment."**

**"At present we use the MAPI Formula for our capital investment program. Prior to its adoption we used a simple mathematical formula to determine how much could be saved through the purchase of new equipment."**

**"We are now bringing out a new type stud which could be used on our present equipment. However, a new machine which we are purchasing will eliminate one costly operation and greatly increase production speed."**

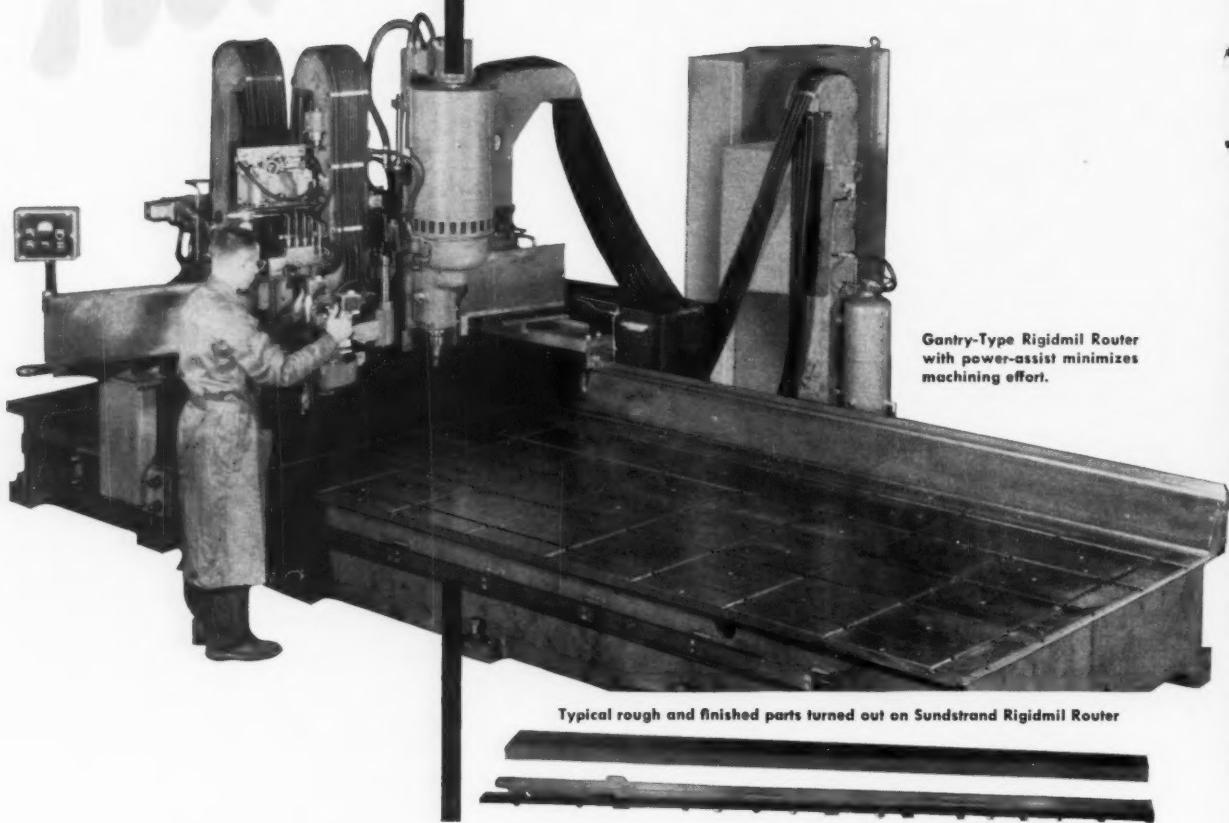
**"Re-investment in a replacement program is, in our opinion, vital to successful growth. This viewpoint of our operating management has had the wholehearted support of our directors."**

***George E. Gregory,***  
**PRESIDENT**  
**GREGORY INDUSTRIES, INC.**

*Keep gathering metalworking production ideas . . . be well informed when you replace machinery.*

ROCKFORD  
INSERT  
GROUP

# Sundstrand Power-Assist Rigidmil Router takes the muscle out of machining



Gantry-Type Rigidmil Router  
with power-assist minimizes  
machining effort.

Typical rough and finished parts turned out on Sundstrand Rigidmil Router

Getting the most out of your Sundstrand Gantry-Type Power-Assist Rigidmil Router doesn't depend on individual operator's strength. With the power-assist doing most of the work, any operator can continue taking husky cuts throughout the entire work day. Sizable work capacity is provided by a four-speed vertical spindle head rated at 15 hp at 7200 rpm. Feed rates over 200 ipm are available so that stock removal is limited only by strength of the cutter and maximum spindle horsepower.

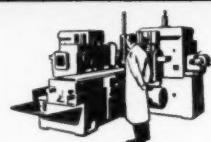
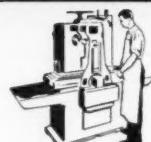
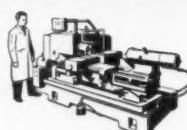
Along with increased output you also get greater precision as the direct result of fingertip control and the reduction in operator fatigue. Conventional routing templates can be used and operator techniques are unchanged.

Power is provided for all three basic movements required in machining with the Rigidmil Router. Longitudinal movement of the gantry and transverse movement of the saddle are controlled by the operator through the power-assist mechanism. Depth movement is controlled by

**SUNDSTRAND**

*"Engineered  
Production  
Service"*  
\*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



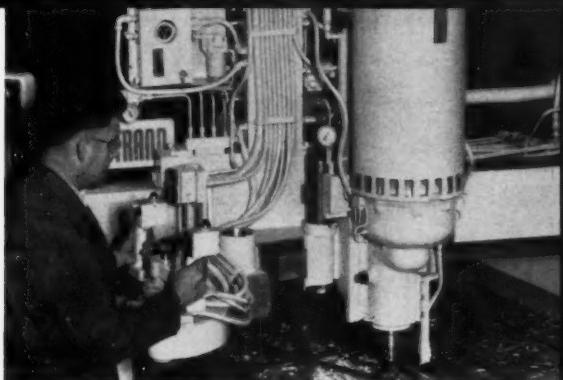
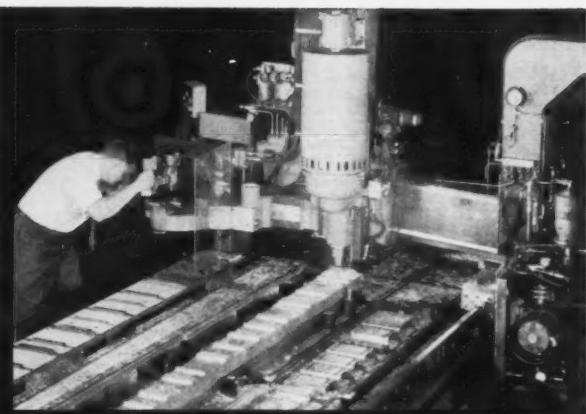
MACHINES DESIGNED TO MEET YOUR NEEDS

**ROCKFORD, ILLINOIS, U.S.A.**

Machinery, January, 1957

a conveniently located push button with the downward movement being limited by a 6-station manually indexed turret stop. Using the stop, limits the depth of cut in any single pass of the router tool and permits accurate pre-setting of the depth of cut.

Either offset routing or overlay template work can be done with the new Sundstrand machine. For offset routing, the stylus is mounted in the stylus quill. When the overlay template method is used, a tracing stylus collar guide is mounted around the cutter spindle nose for following templates mounted directly over the work.



Routing using the overlay template method. A tracing stylus collar guide is mounted around the cutter spindle nose to enable duplication of templates mounted directly over the work.

Here are a few additional details about the Sundstrand Rigidmil Router:

- Spindle center covers a rectangular area over the table 12 ft long by 5 ft wide.
- Stationary table is 17 ft long by 5½ ft wide.
- Feed and rapid traverse rate are both determined by the amount of manual pressure exerted on the power-assist handles. Maximum horizontal travel rate is more than 200 inches per minute.
- Maximum vertical travel rate is over 100 inches per minute.
- Massive construction and full support for router head on Sundstrand Rigidmil Router assures vibration-free operation even when taking full power cuts.

Using the offset method ribs are routed out of solid aluminum slab (top). Work is then turned over and moved to fixture directly to the right for machining of reverse side (bottom). Note that machine table readily accommodates two sets of parts, fixtures and templates for the complete machining job, thus reducing setup time.

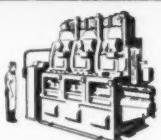
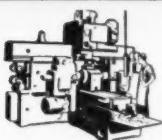


Rigidmil Router Details.  
Learn more about the Sundstrand Power-Assist Rigidmil Router and how it can fit into your production setup by writing for Bulletin 675 today.



#### TRIPLEX RIGIDMILS

#### SPECIAL MACHINES



## SUNDSTRAND Machine Tool Co.

2530 Eleventh St. • Rockford, Ill., U.S.A.



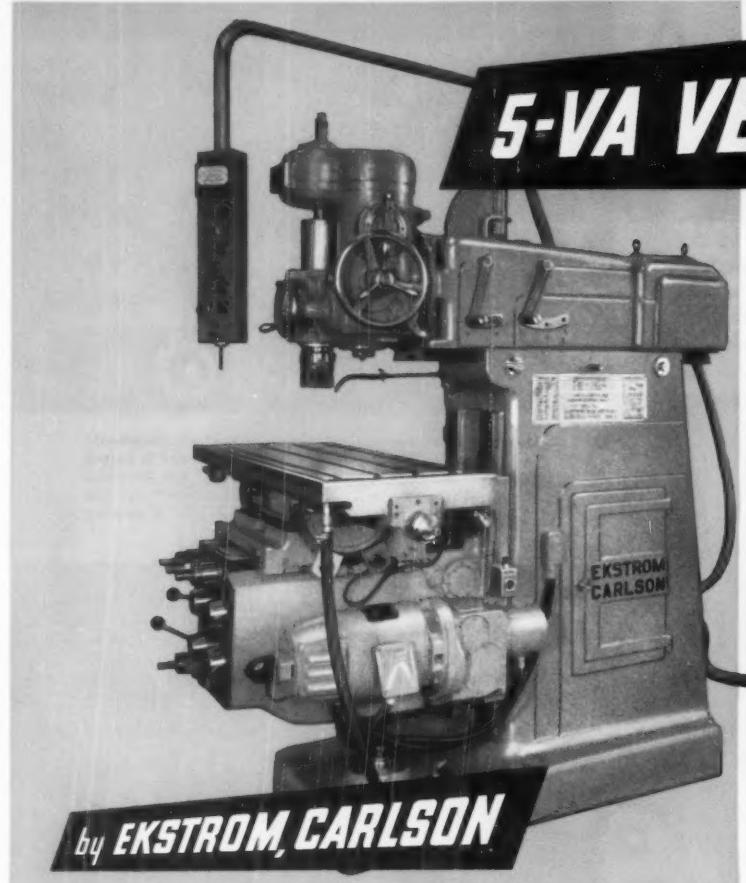
Machinery, January, 1957

CITY OF MACHINE-TOOL SPECIALISTS

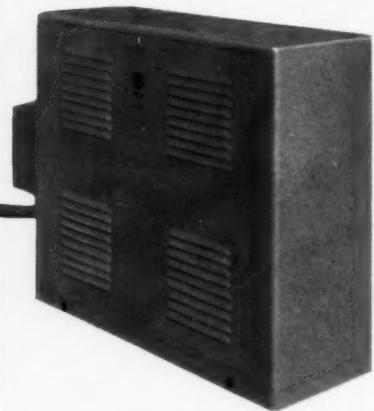
**ROCKFORD, ILLINOIS, U.S.A.**

# 5-VA VERTIMIL

A GREAT  
MACHINE  
MADE EVEN  
GREATER



by EKSTROM, CARLSON



## Electronic INFINITELY-VARIABLE FEEDS INCREASE VERSATILITY TREMENDOUSLY

Here is a really outstanding Vertical-Spindle Milling Machine — for toolroom, job shop, and production use. Newest improvements include electronic controls that give continuously-variable feed ranges of .250" to 100" per minute on longitudinal and cross travel of the table, and from .070" to 38" per minute on vertical travel of the knee; both in two simple stages. A new pendant, convenient to the operator, carries all the control buttons, and the feed-setting arrangements and indicator. New gear-control levers on the knee improve the convenience and efficiency of set-up and operation. All in all, this great machine is hard to beat by the most up-to-date of modern standards. Let us tell you more about it... write for full information.



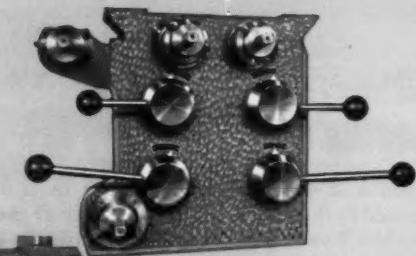
Left, picture shows extreme positions. Table tilts 30° either forward or back, spindle swings 45° to either side.



EKSTROM, CARLSON & CO.

1400 RAILROAD AVE., DEPT. M-4, ROCKFORD, ILLINOIS

Manufacturers of Machinery and Tools Since 1904



Above, manual and power table and knee directional controls are now all concentrated on the front of the knee to save the operator a lot of reaching around.



Left, the control pendant has a feed-rate indicating meter at the top, a master stop stick at the bottom, and all vital operating control buttons and selection switches on the panel.

12 SPINDLE SPEED RANGES  
FROM 72 TO 2480 RPM



CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

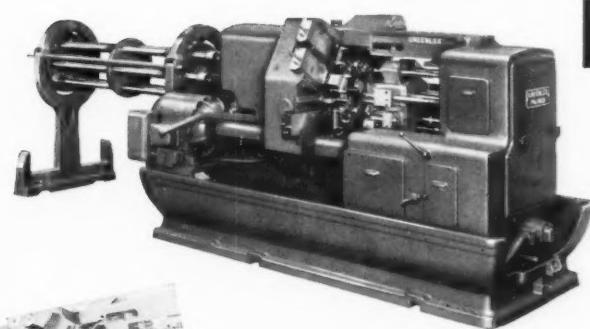
- 1** Simplified cross-slide camming
- 2** Interchangeable cross-slide tool holders
- 3** Quick-adjusting stroke mechanism
- 4** Rapid speed and feed changes
- 5** Wide-open, easily reached tooling area
- 6** Built-in threading feed and drive
- 7** Easily accessible main toolslide holders
- 8** Stationary type collets changed quickly

**eight big  
reasons  
why you get**

*Fast  
Setups*

**on  
GREENLEE  
BAR  
AUTOMATICS**

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits.



**WRITE TODAY  
FOR CATALOG  
A-405**



**4-SPINDLE...6-SPINDLE  
SECOND-OPERATION  
PNEUMATIC STOCK FEED**



**GREENLEE BROS. & CO.  
1861 Mason Avenue  
Rockford, Illinois**

Machinery, January, 1957

**CITY OF MACHINE-TOOL SPECIALISTS    ROCKFORD, ILLINOIS, U.S.A.**



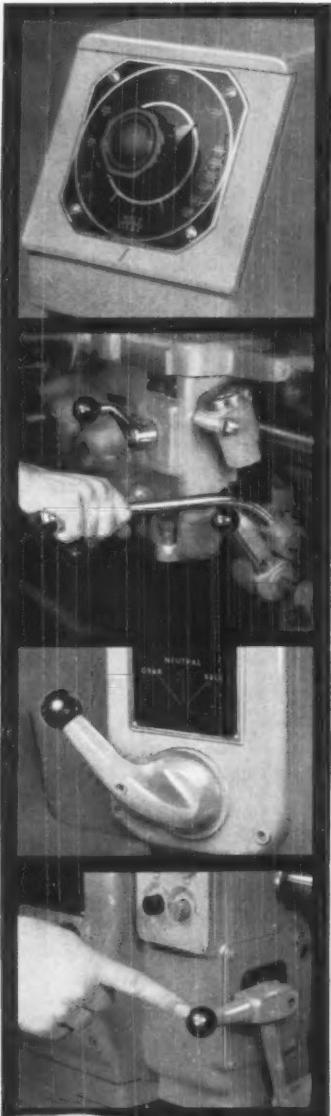
**R**

**T**

**|||||||**

# Hendey

## NO. 2-E LATHE OFFERS THESE TIME-AND MONEYSAVING FEATURES



### 1. Always work at the most efficient cutting speeds

Electronically controlled drive gives you a limitless number of instantly available cutting speeds, between 15 and 1500 rpm. Simply adjust the speed control rheostat (with the machine under load) to select the most efficient speed and reduce cutting time. No calculating necessary. Ideal for facing cuts and turning stepped or tapered diameters.

### 2. Thread-cutting fast and easy

A lever conveniently positioned on the apron controls the sequence of operations when cutting threads — starting, stopping, and reversing the tool *at any time*, whether it is feeding toward or away from the headstock. This is an advantage when chasing odd threads which cannot be picked up on the thread-chasing dial, or on short-run jobs.

### 3. Produce ultimate in fine finish

The belt drive provides smooth, vibration-free power direct to the spindle for speeds of 30 to 1500 rpm, assuring fine-finish performance difficult to match when using a geared drive.

### 4. Reduce nonproductive machine time

Electric brake stops spindle within two seconds, even from the highest speed. There's no coasting or waiting — starting, stopping, and reversing the spindle from preset speeds are accomplished smoothly and rapidly.

*for precision with production*



*Hendey* machine division  
BARBER-COLMAN COMPANY  
11 Loomis St., Rockford, Illinois



Machinery, January, 1957

CENTER OF MACHINE-TOOL EXCELLENCE

**ROCKFORD, ILLINOIS, U.S.A.**

# BARNESDRIL

kleenall  
filters



increase  
parts-  
washing  
efficiency!



Write for Catalog 3505

Barnesdril Kleenall Filters are installed on this conveyor-washer line for a variety of parts-washing. The filters recondition the washing solvent and remove dirt and metal particles automatically.

Formerly 50% of the parts were returned for rewash. Washing nozzles frequently plugged with dirt, causing inefficient washing conditions. The washer was shut down 4 hours a week for removal of as much as 2 cu. yds. of collected dirt.

With Kleenall Filters the washing solution needs changing only once every 6 months. Rewashing is eliminated and output of washed parts is stepped-up 100%. The filter elements remove all dirt and keep the nozzles from plugging. The amount of chemicals used has been reduced by 600 lbs. per month.

Barnesdril engineers have an answer for nearly any kind of liquid clarification problem. Send them yours for analysis and recommendation.

## FILTRATION DIVISION

BARNES DRILL CO.



820 CHESTNUT STREET • ROCKFORD, ILLINOIS  
DETROIT OFFICE: 3419 South Telegraph Road

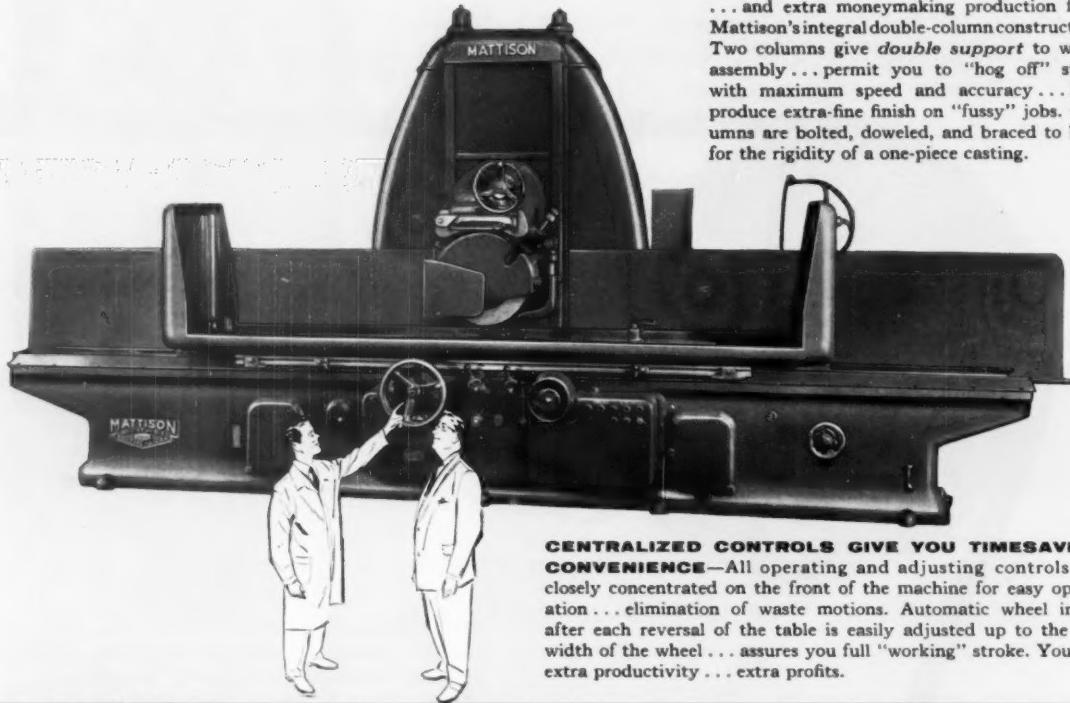
Machinery, January, 1957

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



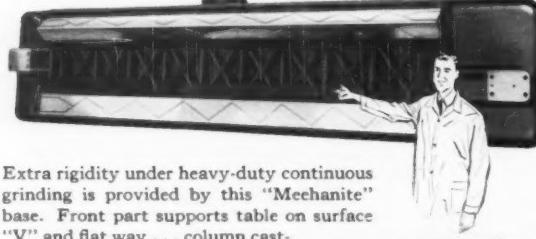
**These "Power-Designed" features  
make this Mattison Surface Grinder  
your kind of machine tool-in every way!**

You get extra stability . . . extra wheel efficiency . . . and extra moneymaking production from Mattison's integral double-column construction. Two columns give *double support* to wheel assembly . . . permit you to "hog off" stock with maximum speed and accuracy . . . help produce extra-fine finish on "fussy" jobs. Columns are bolted, dowled, and braced to base for the rigidity of a one-piece casting.



**CENTRALIZED CONTROLS GIVE YOU TIMESAVING CONVENIENCE**—All operating and adjusting controls are closely concentrated on the front of the machine for easy operation . . . elimination of waste motions. Automatic wheel index after each reversal of the table is easily adjusted up to the full width of the wheel . . . assures you full "working" stroke. You get extra productivity . . . extra profits.

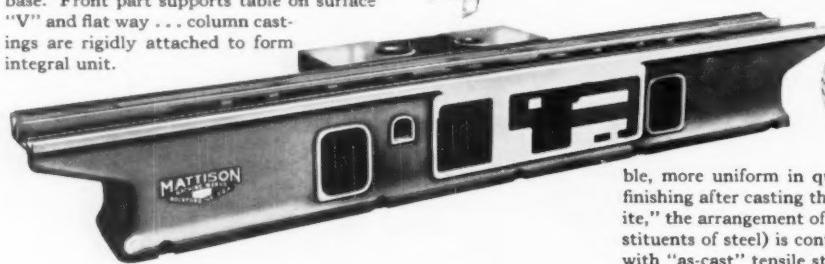
**Heavily cross-ribbed table . . . massive base . . . give you extra rigidity!**



Extra rigidity under heavy-duty continuous grinding is provided by this "Meehanite" base. Front part supports table on surface "V" and flat way . . . column castings are rigidly attached to form integral unit.

This strongly reinforced, cross-ribbed table assures rigid support without distortion . . . even when handling long, heavy castings in large production runs. Use of "V" and flat way gives larger bearing surface . . . precise alignment of work under the wheel. Table never overhangs the bed.

**"MEEHANITE" CASTINGS, WITH ACCURACY THAT WON'T WEAR OFF**



Extra stability and long-lasting accuracy are actually cast into Mattison Grinders by use of "Meehanite" for all castings. "Meehanite" is more durable, more uniform in quality, more adaptable to precision finishing after casting than ordinary cast iron. In "Meehanite," the arrangement of pearlite and graphite (primary constituents of steel) is controlled to produce superior cast iron with "as-cast" tensile strengths as high as 55,000 psi.



Machinery, January, 1957

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

American's "Engineered Production" Service

• It's "power-designed" to give you precision production . . . flexible for use on a wide range of work . . . that's why every type of metalworking shop can make profitable use of at least one Mattison Surface Grinder. Its exclusive features mean higher earnings on continuous production, toolroom or maintenance work . . . its extra horsepower and extra rigidity give you more effective wheel use . . . more productive man-hours . . . better returns on capital investment than any other similar machine. There is a table size available for almost every grinding requirement, ranging from 12 x 36 in. to 36 x 192 in. . . . your dealer will be glad to provide complete details and recommendations or to arrange a sample grind on your parts.

**Double column...direct drive...increase stock removal and precision**

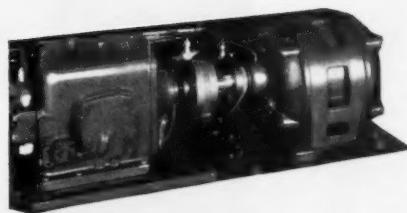


Vertical and wheel-slide assemblies are supported on double-column unit by eight bearing surfaces . . . giving extra stability for rapid stock removal . . . precise adjustment and alignment. Wide bearing surfaces on inside face and dovetail bearing surfaces on the front and back assure accurate downfeeds.



**DIRECT MOTOR DRIVE ELIMINATES SPINDLE VIBRATION...GIVES MORE USABLE POWER**

High-powered motor is mounted directly on the wheel spindle eliminating spindle vibration . . . allowing the wheel to meet the work in correct alignment for more accurate quality and increased wheel efficiency. More usable power makes possible higher wheel speeds . . . heavier feeds . . . increased production . . . shorter job times.



**HYDRAULIC DRIVE ASSURES  
POSITIVE FEED...FINE FINISH  
...FULL USE OF POWER**

Easily controlled, highly efficient table drive is provided by the nondifferential twin cylinder hydraulic drive. Equal speed in either direction . . . fully cushioned smooth reversal . . . positive longitudinal travel . . . and variable speeds up to 100 feet or more per minute are made possible by this unit.

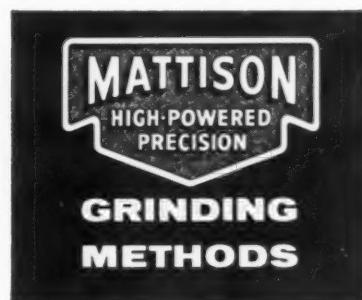
**MATTISON MACHINE WORKS**

**ROCKFORD, ILLINOIS**

If it's a flat surface, there's a Mattison to grind it!

**"Setups"**

Informative, actual application reports of unusual grinding operations have been gathered together in an attractive illustrated booklet—available to you free of charge. Ask your dealer for your free copy of "Setups" . . . or write direct.



Machinery, January, 1957

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

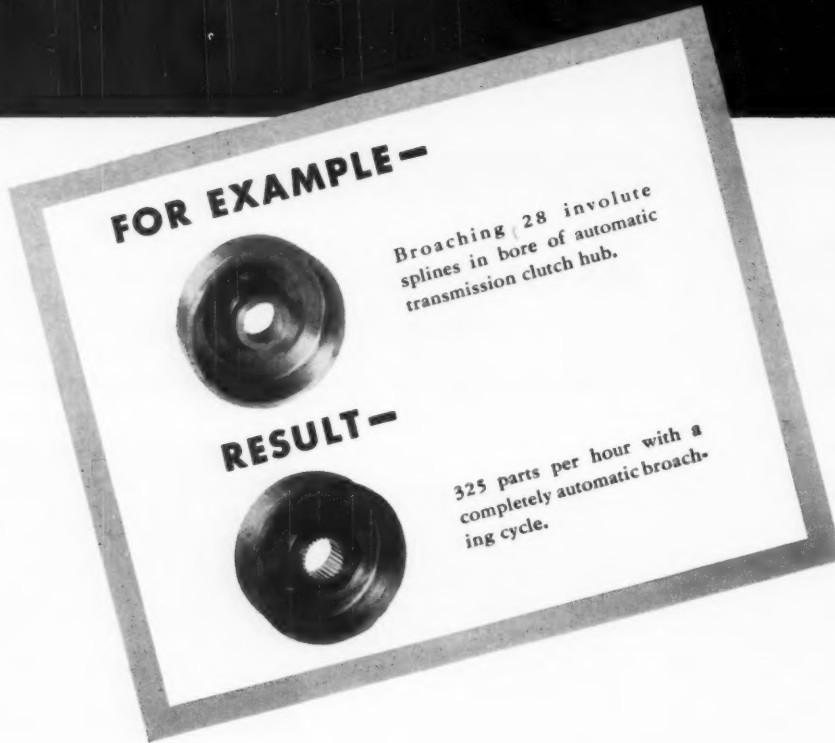


# America's "Engineered Production" Service



... starts with analyzing suitability of the part for broaching, thus guaranteeing you get broaching tools, machines, and fixtures tailored to your specific job. You are actually adding years of experience, unavailable at any price, to your production engineering staff at no extra cost.

It takes  
all **3**  
to give you peak  
broaching performance



1

2

3

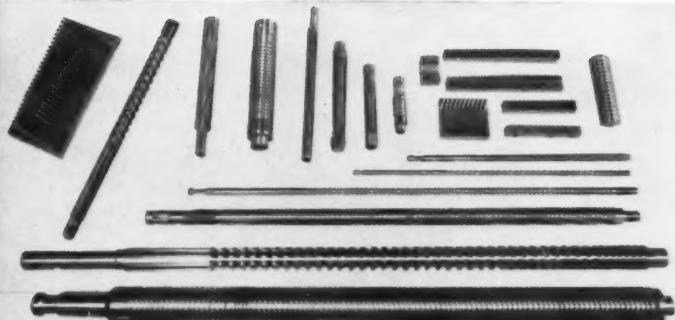


Machinery, January, 1957

CENTER OF MACHINE-TOOL EXCELLENCE    **ROCKFORD, ILLINOIS, U.S.A.**

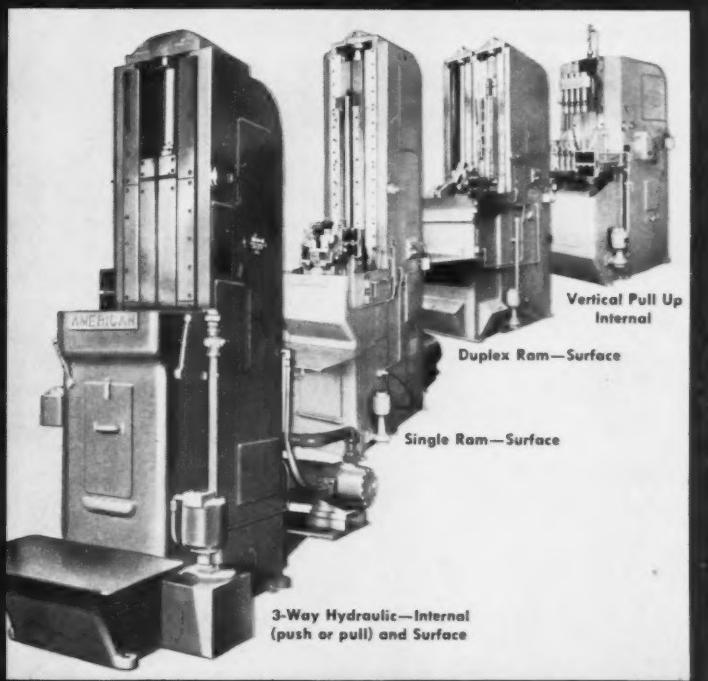
## Proper Broach Design

Practical broaching methods begin with the design of the broaching tool. American Broach solves this all-important first step by considering: stock removal, length and width of cut, finish and tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of the work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.



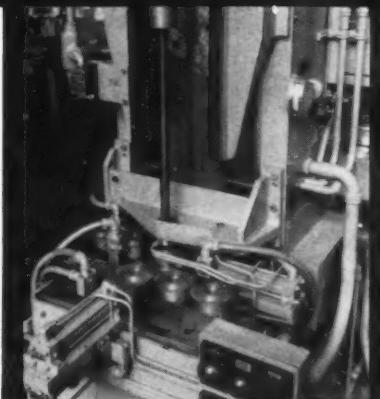
## Specifying the Right Machine

Length and speed of stroke, production rate required, relationship to other production machinery, and available floor space dictate the selection of the broaching machine capable of doing the best broaching job. American not only is experienced with every type of internal and surface broaching job but builds a complete range of broaching machines. You can depend on getting the most practical machine for your job from American Broach.



## Efficient Fixturing

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, work-holding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.



## ADDITIONAL INFORMATION . . .

Write for bulletin No. A610 containing information on practical broaching methods by American.



*American* BROACH & MACHINE CO.  
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.  
ANN ARBOR, MICHIGAN

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Machinery, January, 1957

FOR PRODUCTION MACHINE TOOLS ITS

ROCKFORD, ILLINOIS, U.S.A.



## hydraulic triple circuit

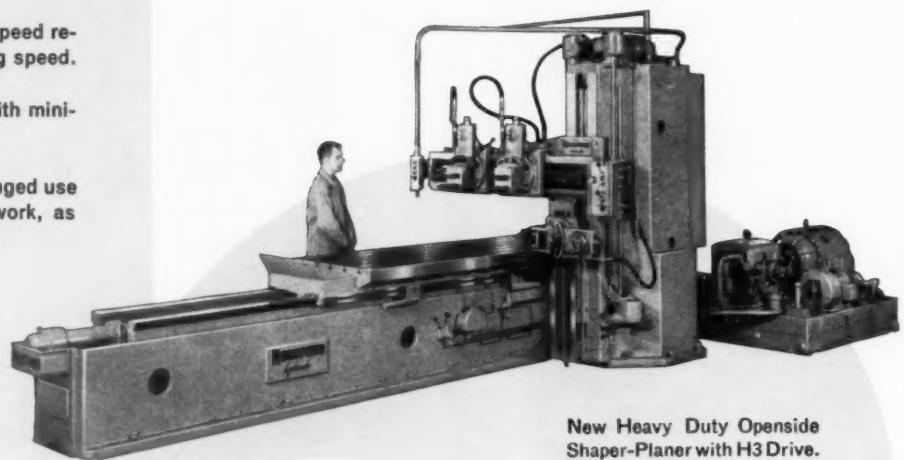
**Infinite Speeds from 10 to 300 fpm., stepped through 3 distinct cutting force ranges.**

**Pendant control of cutting speed selection.**

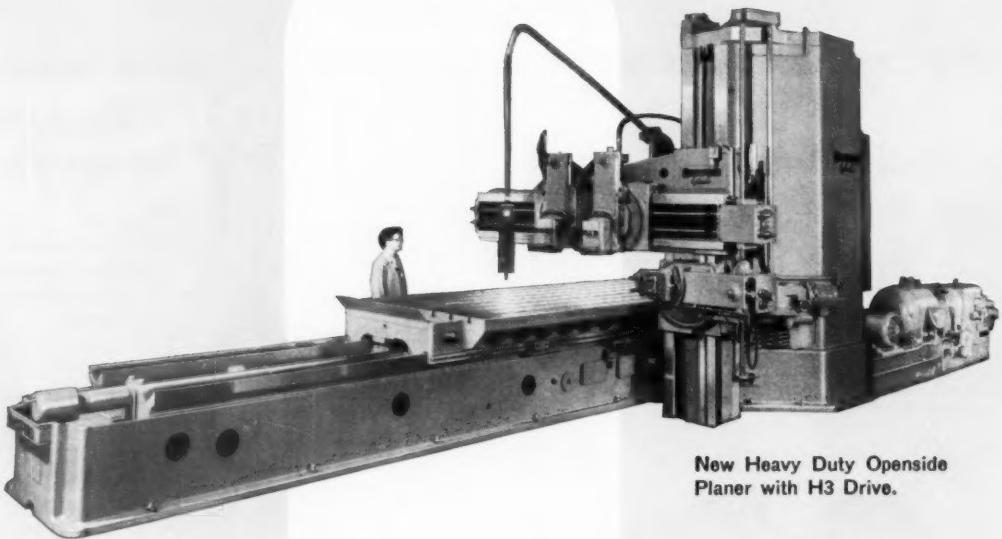
**Maximum return speed regardless of cutting speed.**

**Quick reversals with minimum overtravel.**

**Suitable for prolonged use on short stroke work, as well as long work.**



New Heavy Duty Openside Shaper-Planer with H3 Drive.



New Heavy Duty Openside Planer with H3 Drive.



Machinery, January, 1957

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

provides 3 distinct drives in a single machine!

# h<sup>3</sup> drive

machines free-cutting metals at high cutting speeds  
machines average metals at average cutting speeds  
machines tough metals with slow, heavy cuts

Hydraulic drive and feed inherently provide efficiency and ease in planing and shaping metal. Now a new dimension has been added to this proved efficiency and economy of hydraulic power. This exclusive new feature on Rockford Hydraulic Planers is called h<sup>3</sup> drive—a triple hydraulic circuit to provide the correct combination of cutting speed and required force to most economically machine materials from the free cutting types to the toughest steels.

Many plants, large and small, who are evaluating their present production equipment will find the h<sup>3</sup> drive a significant development in their plans for plant modernization.

We invite you to get full details on this new hydraulic achievement from any Rockford Machine Tool Co. representative, or write directly to us.

**ROCKFORD MACHINE TOOL CO.**  
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

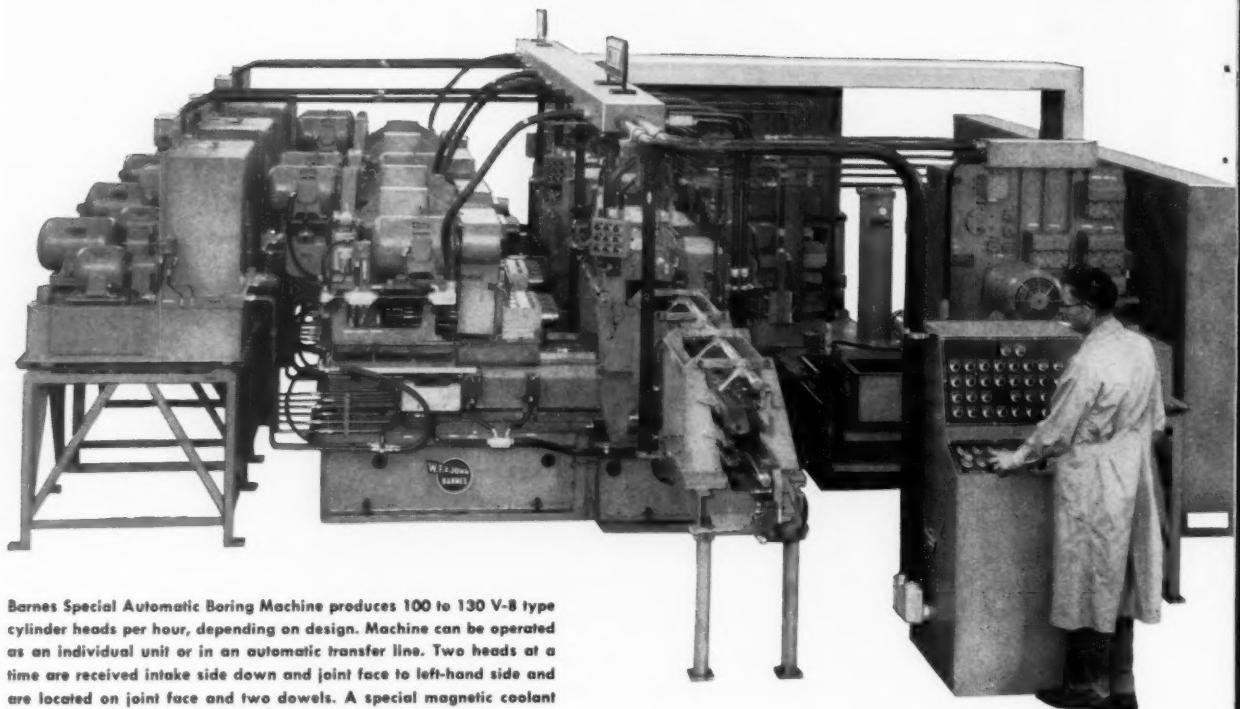
h<sup>3</sup>  
drive

Machinery, January, 1957

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



# Now Available— NEW MACHINING AUTOMOTIVE



Barnes Special Automatic Boring Machine produces 100 to 130 V-8 type cylinder heads per hour, depending on design. Machine can be operated as an individual unit or in an automatic transfer line. Two heads at a time are received intake side down and joint face to left-hand side and are located on joint face and two dowels. A special magnetic coolant separator removes metal chips, insuring a fine machined surface.

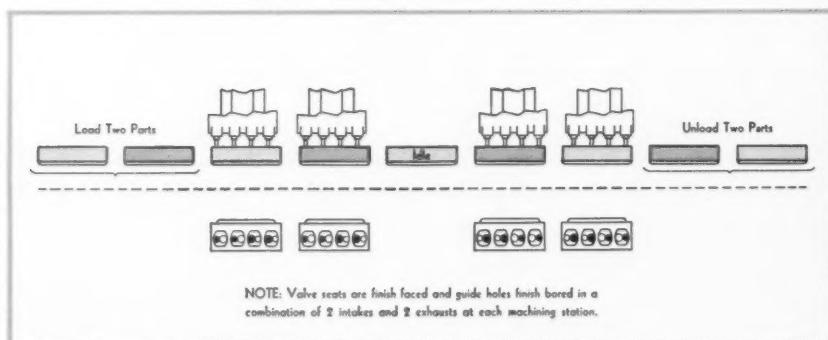
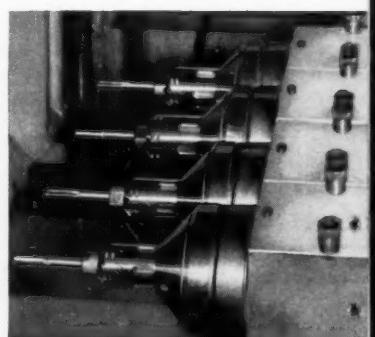


Diagram above illustrates how heads are transferred two at a time and machining operations arranged to meet high output requirements. For lower production, machines are designed with fewer machining stations and one-station transfer unit.



Closeup of 4-spindle head with special tools for machining four valve seats and stem holes in one pass. Second 4-spindle head completes remaining operations.



**Builders of Better Machines Since 1872**

MULTIPLE SPINDLE DRILLING • BORING • TAPPING

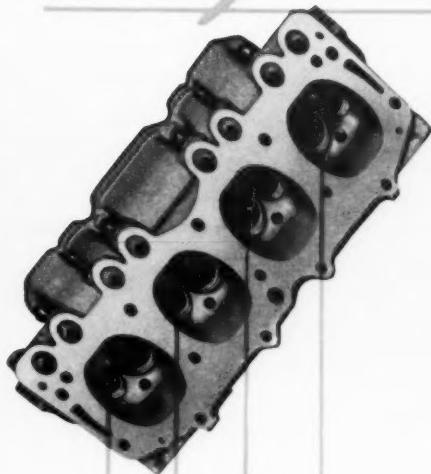


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Machinery, January, 1957

# PRECISION METHOD OF FINISH VALVE SEATS AND STEM HOLES

*Automatically*



Cylinder head for V-8 engine showing finish machined valve seats and guide holes. Red arrows indicate operations performed at first machining station.

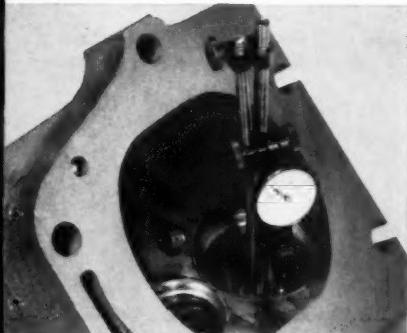
## EXCLUSIVE W. F. & JOHN BARNES MACHINING DEVELOPMENT HOLDS TOTAL CONCENTRICITY WITHIN .0005"

Now, a new precision machining method developed exclusively by W. F. & John Barnes makes it possible for you to finish machine automotive valve seats and stem holes on a continuous automatic basis. You can now eliminate corrective operations after normal boring, reaming, and seating operations, because this new development holds total concentricity within .0005" (total indicator reading). This new machining process, as incorporated into Barnes Automatic Progress-Thru Type Machines, consists of multi-blade tooling for the valve seating operations, combined with modified gun drilling tools for precision boring valve guide holes. Production tests show the valve seat tools produce 10,000 to 15,000 parts, and the boring tools, between 2,500 and 4,000, before regrinding or replacement is necessary. The net result has increased production efficiency and improved product quality at lower cost. Write for more facts today.

## TO SAVE TIME INVESTIGATE BARNES' 6-POINT MACHINE TOOL BUILDING SERVICE

For over 75 years, Barnes has designed and built special machinery. These years of experience can assist you in saving time and cutting costs. Check

the advantages of an engineering and building service from one convenient source.



Concentricity of valve seat and stem hole held to .0005" total indicator reading.

**1** SPECIALIZED MANUFACTURING FACILITIES—75-year background, large well equipped plant efficiently tooled to build high production machines.

**2** SPECIAL HYDRAULIC EQUIPMENT—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

**3** SPECIAL ELECTRICAL EQUIPMENT and CONTROLS—individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.

**4** SPECIAL GAUGES, FIXTURES, TOOLS—designed for each individual machining problem, assure accuracy of operations at high production speeds.

**5** SPECIAL HANDLING AND CONVEYOR EQUIPMENT—designed and built to reduce work handling, effect maximum safety and efficiency.

**6** COORDINATED DESIGN AND ENGINEERING—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

### WRITE FOR FREE BOOKLET

Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service.



**W. F. & JOHN BARNES COMPANY**  
**310 SOUTH WATER STREET, ROCKFORD, ILLINOIS**

MACHINES • AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

Machinery, January, 1957

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



# REQUEST FOR ADDITIONAL INFORMATION

**American Broach & Machine Co.**  
Div. Sundstrand Machine Tool Co.

**Barber-Colman Company**

**Barnes Drill Co.**

**John S. Barnes Corporation**

**W. F. & John Barnes Co.**

**Ekstrom, Carlson & Co.**

**Greenlee Bros. & Co.**

**Mattison Machine Works**

**Rockford Machine Tool Co.**

**Sundstrand Machine Tool Co.**

- |  |  |
|--|--|
| <input type="checkbox"/> Broaching Machines<br><input type="checkbox"/> Broach Sharpeners<br><input type="checkbox"/> Special Machinery  | <input type="checkbox"/> Presses<br><input type="checkbox"/> Broaching Tools<br><input type="checkbox"/> Broaching Fixtures  |
| <input type="checkbox"/> Hobbing Machines<br><input type="checkbox"/> Milling Cutters<br><input type="checkbox"/> Engine and Toolroom Lathes   | <input type="checkbox"/> Sharpening Machines<br><input type="checkbox"/> Hobs<br><input type="checkbox"/> Reamers  |
| <input type="checkbox"/> Honing Machines<br><input type="checkbox"/> Drilling Machines<br><input type="checkbox"/> Magnetic Coolant Separators   | <input type="checkbox"/> Honing Tools<br><input type="checkbox"/> Tapping Machines<br><input type="checkbox"/> Combination Coolant Filters   |
| <input type="checkbox"/> Reaming Machines<br><input type="checkbox"/> Transfer Machines<br><input type="checkbox"/> Hydraulic Coolant Separators   | <input type="checkbox"/> Special High Production Units<br><input type="checkbox"/> Hydraulic Controls  |
| <input type="checkbox"/> Hydraulic Pumps—Gear, Piston and Vane<br><input type="checkbox"/> Hydraulic Power Units—J.I.C. and non-J.I.C.<br><input type="checkbox"/> Hydraulic Cylinders<br><input type="checkbox"/> Fluid Motors  | <input type="checkbox"/> Hydraulic Controls  |
| <input type="checkbox"/> Multiple-Spindle Drilling and Tapping Machines<br><input type="checkbox"/> Horizontal and Vertical Boring Machines<br><input type="checkbox"/> Progress-Through and Transfer-Type Machines<br><input type="checkbox"/> Special Deep-Hole Drilling, Boring and Honing Machines<br><input type="checkbox"/> Assembly Machines<br><input type="checkbox"/> Special Processing and Handling Equipment         | <input type="checkbox"/> Cavity Milling Machines<br><input type="checkbox"/> "Power-Arm" Routing & Milling Machines<br><input type="checkbox"/> Radial Arm Routers<br><input type="checkbox"/> Aircraft Routers (Horn, Trim, or Pin)<br><input type="checkbox"/> Routing Tools (Spiral or Straight Flute)<br><input type="checkbox"/> Scarf Edge Milling Machines<br><input type="checkbox"/> Depth and Contour Milling Machines |
| <input type="checkbox"/> Vertical Milling Machines<br><input type="checkbox"/> "Power-Arm" Routing & Milling Machines<br><input type="checkbox"/> Radial Arm Routers<br><input type="checkbox"/> Aircraft Routers (Horn, Trim, or Pin)<br><input type="checkbox"/> Routing Tools (Spiral or Straight Flute)<br><input type="checkbox"/> Scarf Edge Milling Machines<br><input type="checkbox"/> Depth and Contour Milling Machines | <input type="checkbox"/> 3-D Milling Machines<br><input type="checkbox"/> Radial Arm Drills<br><input type="checkbox"/> Cavity Milling Machines<br><input type="checkbox"/> "Power-Arm" Routing & Milling Machines<br><input type="checkbox"/> 3-D Milling Machines  |
| <input type="checkbox"/> Multiple-Spindle Automatic Bar Machines<br><input type="checkbox"/> Special-Purpose Multiple-Spindle Drilling, Boring, Tapping, and Milling Machines<br><input type="checkbox"/> Automatic Transfer-Type Machines<br><input type="checkbox"/> Hydro-Borer Precision Boring Machines   | <input type="checkbox"/> Surface Grinders —<br>Horizontal Spindle<br><input type="checkbox"/> Way Grinders<br><input type="checkbox"/> Face Grinders<br><input type="checkbox"/> Disc Grinders<br><input type="checkbox"/> Abrasive Belt Grinding and Polishing Machines<br><input type="checkbox"/> Wide Belt<br><input type="checkbox"/> Internal Tube   |
| <input type="checkbox"/> Shapers<br><input type="checkbox"/> Planers<br><input type="checkbox"/> Slotters<br><input type="checkbox"/> Shaper-Planers   | <input type="checkbox"/> Slotters<br><input type="checkbox"/> Shaper-Planers   |
| <input type="checkbox"/> Economy Lathes  | <input type="checkbox"/> Hydraulic Kopy-Kat Duplicators  |
| <input type="checkbox"/> Automatic Lathes<br><input type="checkbox"/> Tracer Lathes<br><input type="checkbox"/> Special Machines<br><input type="checkbox"/> Bench Centers<br><input type="checkbox"/> Portable Sanding Machines<br><input type="checkbox"/> Magnetic Chucks and Separators  | <input type="checkbox"/> Milling Machines<br><input type="checkbox"/> Transfer Machines<br><input type="checkbox"/> Centering Machines<br><input type="checkbox"/> Balancing Tools   |

**IMPORTANT**

To help us furnish promptly the information requested, please give the date of the Rockford Insert to which you are referring.

Name \_\_\_\_\_

Title \_\_\_\_\_

Firm \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_

Zone \_\_\_\_\_ State \_\_\_\_\_

**Be Sure That Every Line Above is Filled in Clearly and Mail Your Reply to:**

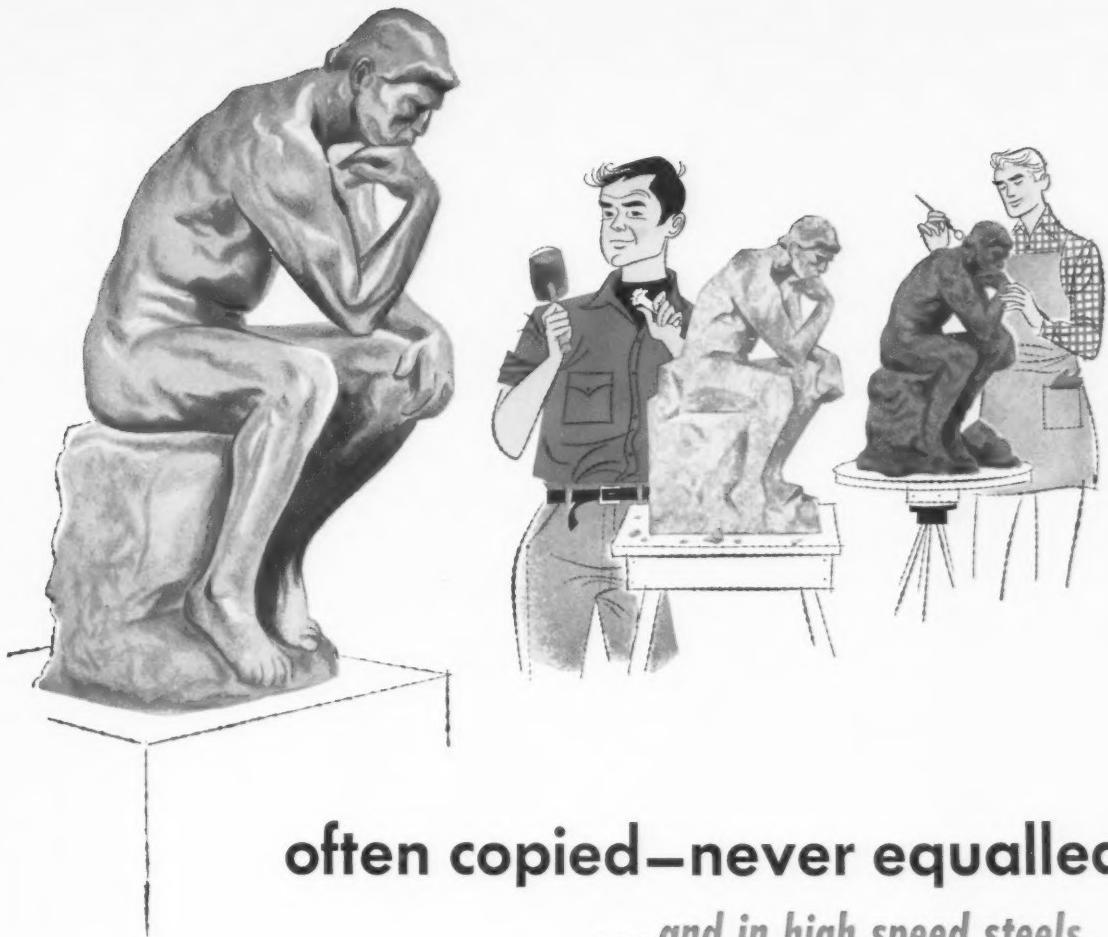
**ROCKFORD INSERT GROUP** C/O ADAMS' LETTER SERVICE  
222 N. ROCKTON AVENUE **ROCKFORD, ILLINOIS, U. S. A.**



Machinery, January, 1957

MACHINES DESIGNED TO MEET YOUR NEEDS

**ROCKFORD, ILLINOIS, U.S.A.**



**often copied—never equalled**  
*...and in high speed steels,  
 nothing has ever equalled REX*

Crucible's REX® high speed steel is in a class by itself — has been for more than half a century. And it gets better every year. New improvements in manufacturing techniques have brought even greater uniformity and quality to its well-known properties.

But prove this for yourself—shop-test the new REX in your own plant. Check its structure, uniformity, response to heat-treatment—all-around tool performance. Try REX any way you like — you'll see for yourself why the new REX is still the *standard for comparison* in every high speed steel application.

You can get REX from stock from your nearby Crucible warehouse—or promptly by direct mill delivery. For further information on REX and the many other Crucible special purpose steels, send for the *Crucible Publication Catalog* — it's yours for the asking. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

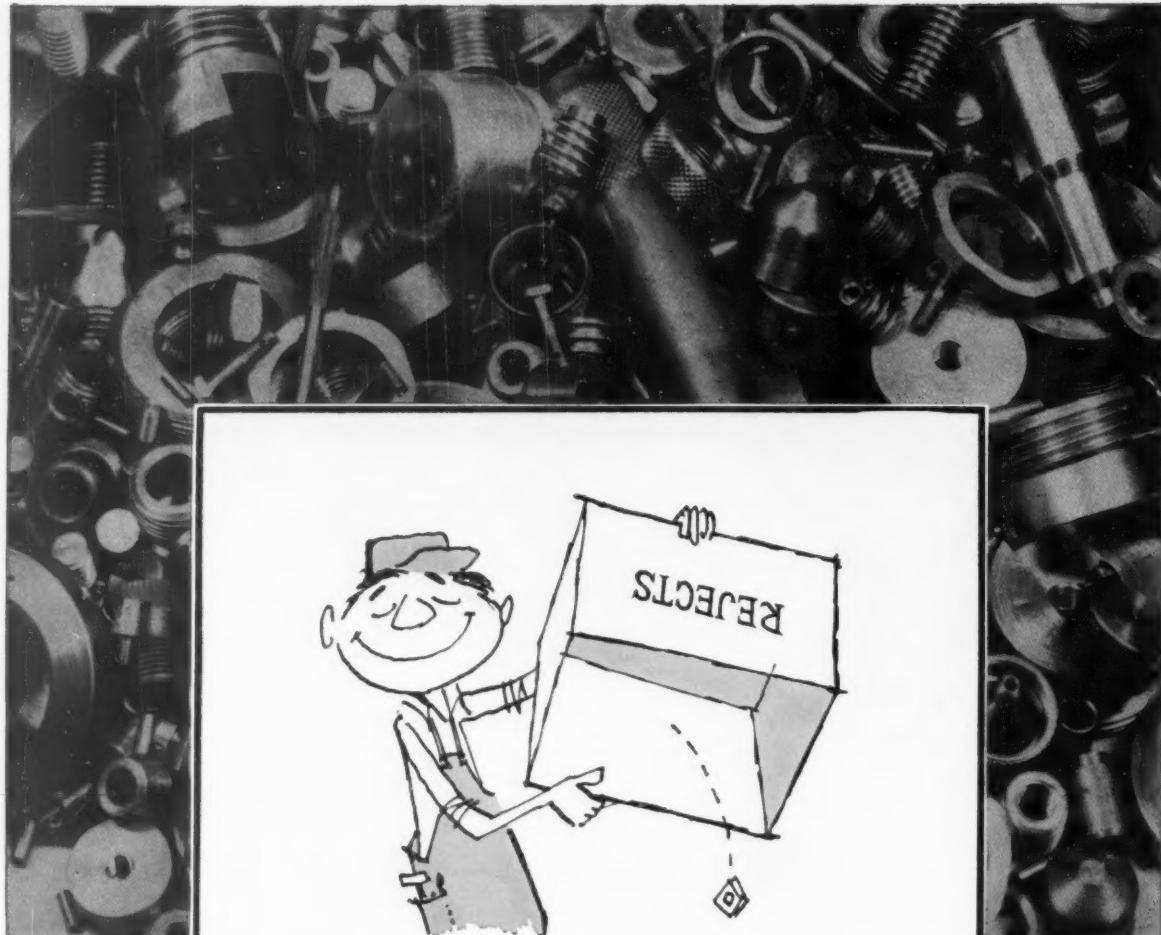
**CRUCIBLE**

first name in special purpose steels

**Crucible Steel Company of America**

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—85



REJECTIONS dwindle to a new low when you start running on USS Free-Machining MX Steel.

It's a fact. Ever since this faster-cutting bar stock was developed, and in every shop where MX has been put to work, not only have more parts per hour been produced but they have been *better* parts. Better in finish, accurate in dimension, lower in cost—and with fewer rejects to cut into profits.

These highly desirable results are obtained with USS MX primarily because of its superior machinability,

and also because this steel is consistently uniform in shipment after shipment. Uniform in cutting characteristics. Uniform in its composition and grain size. Uniform in freedom from defects and injurious imperfections.

Give USS MX a trial in your shop and watch production go up and costs come down. The performance of MX has been so universally superior that we feel sure that it will cut the cost of any part you now machine from ordinary screw stock.

USS Free-Machining MX is pro-

duced in both Bessemer and Open Hearth grades and is available in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH  
AMERICAN STEEL & WIRE DIVISION, CLEVELAND  
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO  
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.

UNITED STATES STEEL SUPPLY DIVISION  
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST  
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Bigger output... longer tool life... fewer rejects  
—when you do the job with free-machining

**MX**

UNITED STATES STEEL

STRIP  
RINSE  
PICKLE  
RINSE  
NEUTRALIZE  
RINSE

## Here's the best shortcut in the field of organic finishing

One operation usually removes paint, rust and oil at the same time.

One tank of Oakite Rustripper frequently does all these jobs: (1) strip rejects and conveyor hooks; (2) pickle rusted stock; (3) prepare reconditioned products for refinishing operations.

One tank may eliminate many tanks used in ordinary cycles.

### OAKITE RUSTRIPPER

RINSE

PREPAINT DRY PAINT



**FREE** Our illustrated booklet tells how this amazing cleaner - stripper - derustener offers tremendous possibilities for saving minutes, hours, dimes, dollars. Write or send coupon for your copy.

ALKALINE CLEAN  
RINSE  
PICKLE  
RINSE  
ELECTROCLEAN  
RINSE

## Here's the best shortcut in the field of electroplating

One operation usually removes rust and oil at the same time. One alkaline tank may remove oxides, drawing compound residues and other stubborn soils . . . even strip zinc from rejects and racks.

Sensational Oakite Rustripper frequently eliminates acid pickling and its troublesome after-effects: (1) hydrogen embrittlement; and (2) smut that must be removed by electro-cleaning or hand brushing.

### OAKITE RUSTRIPPER

RINSE

ELECTROPLATE RINSE CYANIDE or ACID DIP



**FREE** Our illustrated booklet tells how this shortcut may save you time and money—in tank lines, in automatic platers, in barrel lines—by saving equipment, floor space, acids, water, steam and electricity. Write or send coupon for your copy.

Technical Service Representatives in  
Principal Cities of U. S. and Canada



**OAKITE PRODUCTS, INC.**  
26 Rector St., New York 6, N. Y.

Send me a free copy of the booklet checked:

- "Here's the best shortcut in the field of organic finishing"  
 "Here's the best shortcut in the field of electroplating"

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

# HALLMARK OF QUALITY FORGINGS



For centuries the skilled craftsman has shown his pride in his workmanship by identifying his work with a "mark".

The trade-mark of the National Forge and Ordnance Company stamped on your forging is your guarantee that the forging has been carefully and skilfully made to meet your specifications exactly.

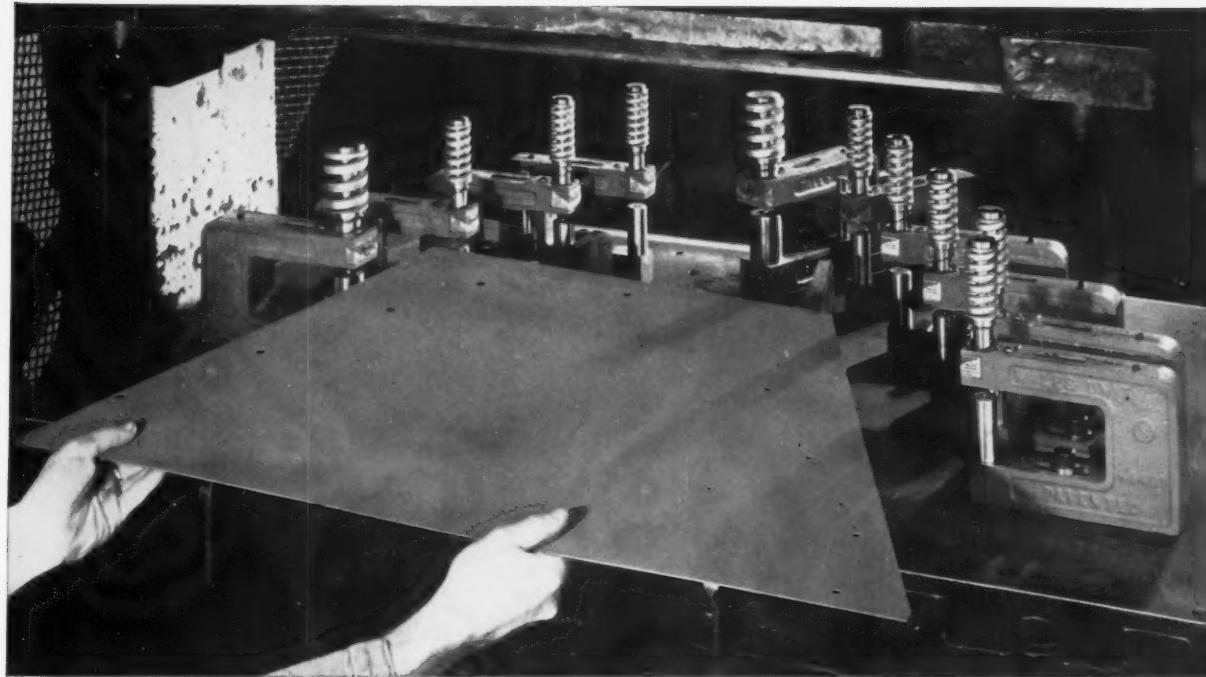


NATIONAL FORGE  
& ORDNANCE CO.

IRVINE, WARREN COUNTY, PENNA.



# Tool Steel Topics



## Omega Punches, Used in Multiple Units, Provide Big Savings in Metal Punching

If you'd like to see some interesting metal-punching jobs, the place to visit is Wales-Strippit Company, at North Tonawanda, N. Y. There they employ about every punching operation imaginable, using self-contained punching units which are set up quickly to meet the requirements for varied hole sizes or shapes.

One of the tool steel grades which has been doing a fine job of minimizing shop costs at Wales-Strippit Company is Bethlehem Omega, a super-tough steel supplied by Leed Steel Co., Buffalo. Omega's dependability and long service life have been remarkable . . . all the more so because it is used exclusively in punching

hard metals, where high shock-resistance heads the list of requirements.

Omega is our "super" grade of oil-hardening, shock-resisting tool steel. It can also be quenched in water. Here's its typical analysis:

| C    | Mn   | Si   | Mo   | Va   |
|------|------|------|------|------|
| 0.60 | 0.70 | 1.85 | 0.45 | 0.25 |

Omega isn't limited to service in punches, either. It's just what the doctor ordered for hand and pneumatic chipping chisels, knockout pins, swaging dies, shear blades, and other uses where the steel is continually subjected to severe shock.

## BETHLEHEM TOOL STEEL ENGINEER SAYS:



### Oxide Skin Improves Lehigh H

Most users of hot-work steels know that the oxide skin, put on the surface of tools by the second temper, is beneficial. This oxide coating serves partly as a lubricant, and also helps conventional lubricants to adhere, thus increasing wear-resistance.

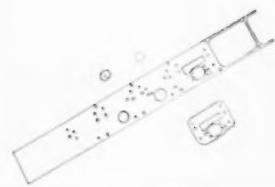
When tempers above 900 F are used, Lehigh H tool steel is also benefited in the same way by the oxide coating resulting from the second temper. Here is the sequence of operations to be followed in heat-treating Lehigh H, so as to take advantage of the oxide coating:

1. Heat the tool and quench it in the conventional manner.
2. Temper at 925 F (or higher for some purposes).
3. Grind the tool to size, and remove scale and decarburization.
4. Retemper the tool at 900 F. Do not grind or remove the light oxide coating—use the tool with this surface.

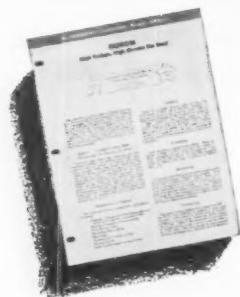
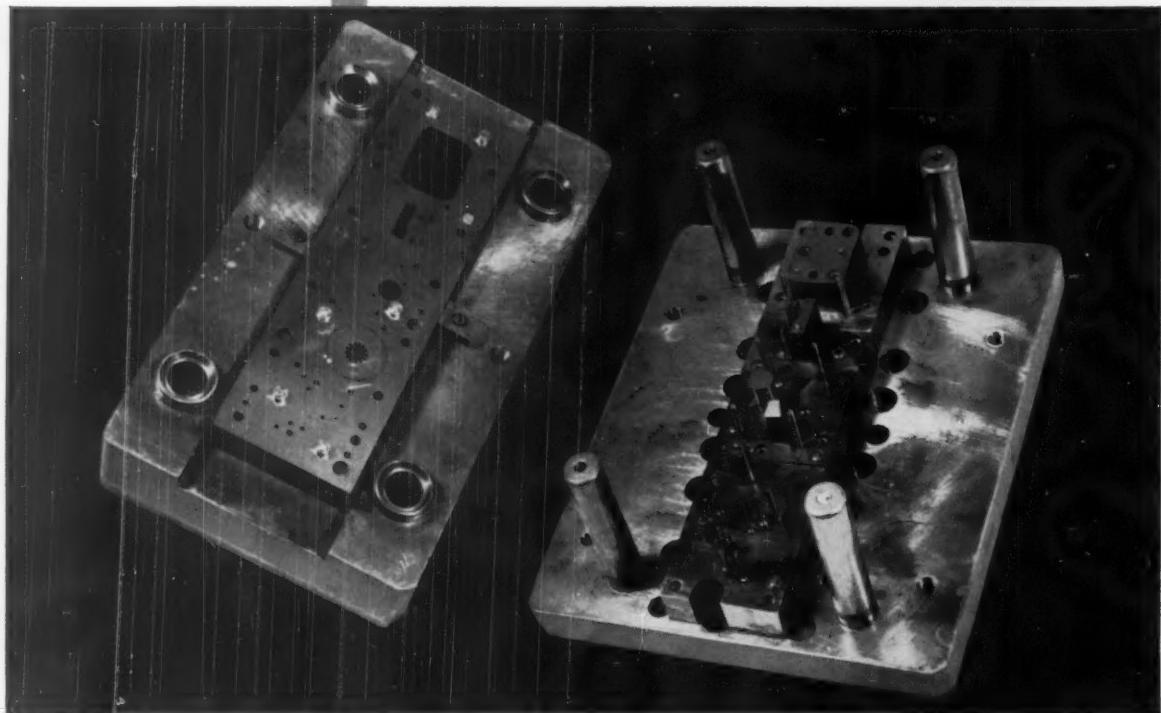


## Making Plastic Parts? Use Lustre-Die

Lustre-Die, our new plastic-molding tool steel, is really something! What a high polish it takes! And what high lustre you get on the finished parts! Lustre-Die has a well-balanced analysis, and is alloy fortified to increase its depth of hardenability and mechanical properties. It's good steel. You'll like it.



## This HURON Lamination Die Gave Initial Run of 426,000!



### Write for BLUE SHEET on HURON

This concise four-page folder gives all needed handling and shop treatment details on Huron. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. Ask for your copy.

ADDRESS DEPT. M-85

**A-L HURON** high-carbon, high-chrome die steel was the material used in this motor lamination die. Here was the result when the die was run on a 45-ton Bliss press at 210 strokes a minute:

- 1 Initial run was 426,000 pieces
- 2 Average run since has been 250,000 pieces
- 3 Although burr tolerance is .003", grinding of punch and die between runs has not exceeded .008".

**HURON WAS SELECTED** because of its known high resistance to wear, especially under heavy pressures, and its excellent non-deforming qualities. Because Huron is an oil-hardening steel and hardens uniformly to a great depth, a consistent production rate after each grind was assured.

There's an A-L Tool Steel that will help solve your cutting, forming or blanking problem. Call our nearest office or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

**For nearest representative, consult Yellow Section of your telephone book.**

For complete MODERN Tooling, call

**Allegheny Ludlum**

WSW 6384



| LAST MONTH |    |    |    |    | JANUARY 1956 |     |     |     |     | NEXT MONTH |     |    |    |    |    |    |    |
|------------|----|----|----|----|--------------|-----|-----|-----|-----|------------|-----|----|----|----|----|----|----|
| S          | M  | T  | W  | F  | Sun          | Mon | Tue | Wed | Thu | Fri        | Sat | S  | M  | T  | W  | F  | S  |
| 4          | 5  | 6  | 7  | 8  | 9            | 10  | 11  | 12  | 13  | 14         | 15  | 16 | 17 | 18 | 19 | 20 | 21 |
| 11         | 12 | 13 | 14 | 15 | 16           | 17  | 18  | 19  | 20  | 21         | 22  | 23 | 24 | 25 | 26 | 27 | 28 |
| 18         | 19 | 20 | 21 | 22 | 23           | 24  | 25  | 26  | 27  | 28         | 29  | 30 | 31 | 29 | 30 | 31 | 1  |
| 25         | 26 | 27 | 28 | 29 | 30           | 31  |     |     |     |            |     |    |    |    |    |    |    |

Phone your  
order for 52100  
tubing today

JANUARY 18 WEDNESDAY

| LAST MONTH |    |    |    |    | JANUARY 1956 |     |     |     |     | NEXT MONTH |     |    |    |    |    |    |    |
|------------|----|----|----|----|--------------|-----|-----|-----|-----|------------|-----|----|----|----|----|----|----|
| S          | M  | T  | W  | F  | S            | Mon | Tue | Wed | Thu | Fri        | Sat | S  | M  | T  | W  | F  | S  |
| 4          | 5  | 6  | 7  | 8  | 9            | 10  | 11  | 12  | 13  | 14         | 15  | 16 | 17 | 18 | 19 | 20 | 21 |
| 11         | 12 | 13 | 14 | 15 | 16           | 17  | 18  | 19  | 20  | 21         | 22  | 23 | 24 | 25 | 26 | 27 | 28 |
| 18         | 19 | 20 | 21 | 22 | 23           | 24  | 25  | 26  | 27  | 28         | 29  | 30 | 31 | 29 | 30 | 31 | 1  |
| 25         | 26 | 27 | 28 | 29 | 30           | 31  |     |     |     |            |     |    |    |    |    |    |    |

...we'll ship  
within  
24 hours!

JANUARY 19 THURSDAY

WHEN the problem is a rush hollow parts job, phone or wire the Timken Company and we'll ship less-than-mill quantities of 52100 tubing within 24 hours after receiving your order.

Timken® 52100 steel tubing is excellent for most of your high quality hollow parts jobs. It's a through-hardening steel in moderate sections. It can be heat treated to file hardness and tempered back

to any desired point. And it can frequently be used in place of more expensive steels.

Available in sizes from 1" to 10½" O.D., Timken 52100 steel is used for hollow parts such as: aircraft parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts, precision instruments, and dozens of others.

The Timken Company is Ameri-

ca's pioneer producer of 52100 tubing. And we're the only company that makes 52100 steel in tubing, bars and wire. Our unequalled experience assures you of uniform quality from tube to tube and heat to heat.

For immediate delivery of your less-than-mill quantity orders, write, wire or phone The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

# TIMKEN Fine Alloy STEEL

TRADE-MARK REG. U. S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 233

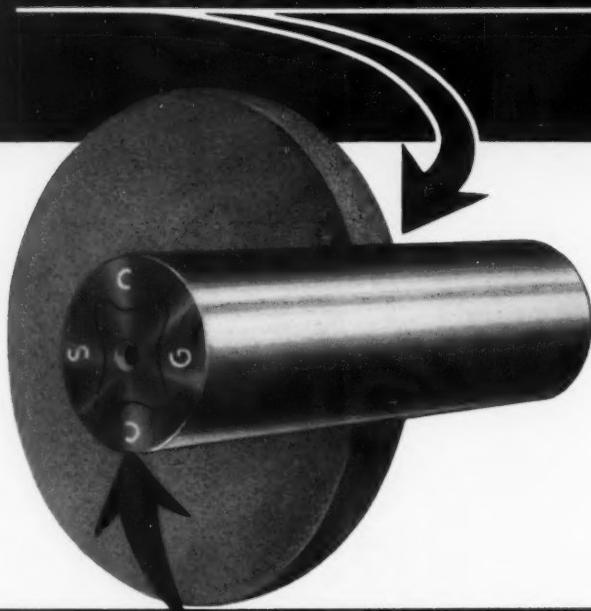
MACHINERY, January, 1957—91

An exclusive **GRINDING PROCESS...**

makes

## CUMBERLAND STEEL BARS

concentric, straight,  
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

## CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

### MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.

Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.

Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

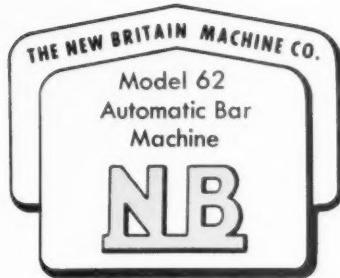
## CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

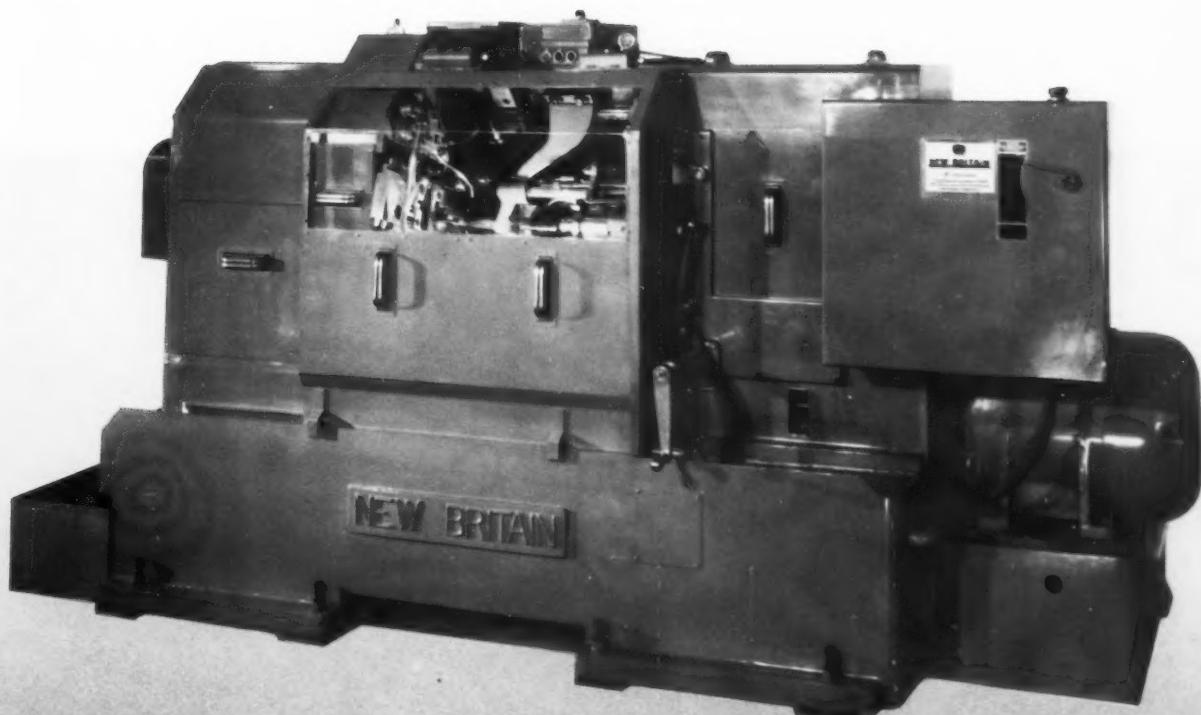
ESTABLISHED 1845

INCORPORATED 1892

**a long new step forward  
in bar machine productivity**

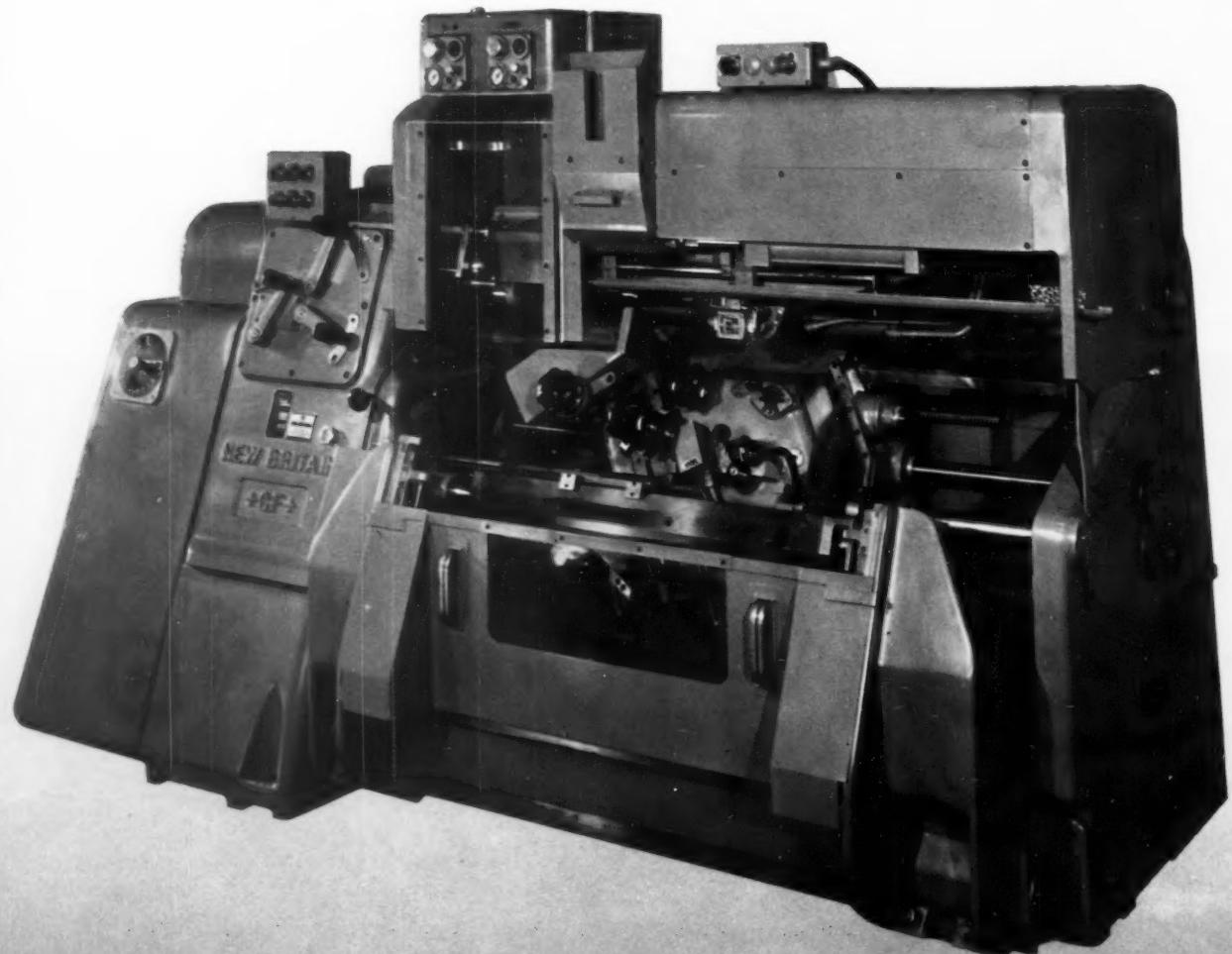
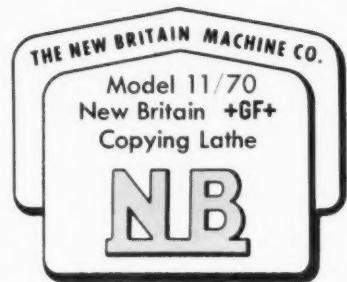


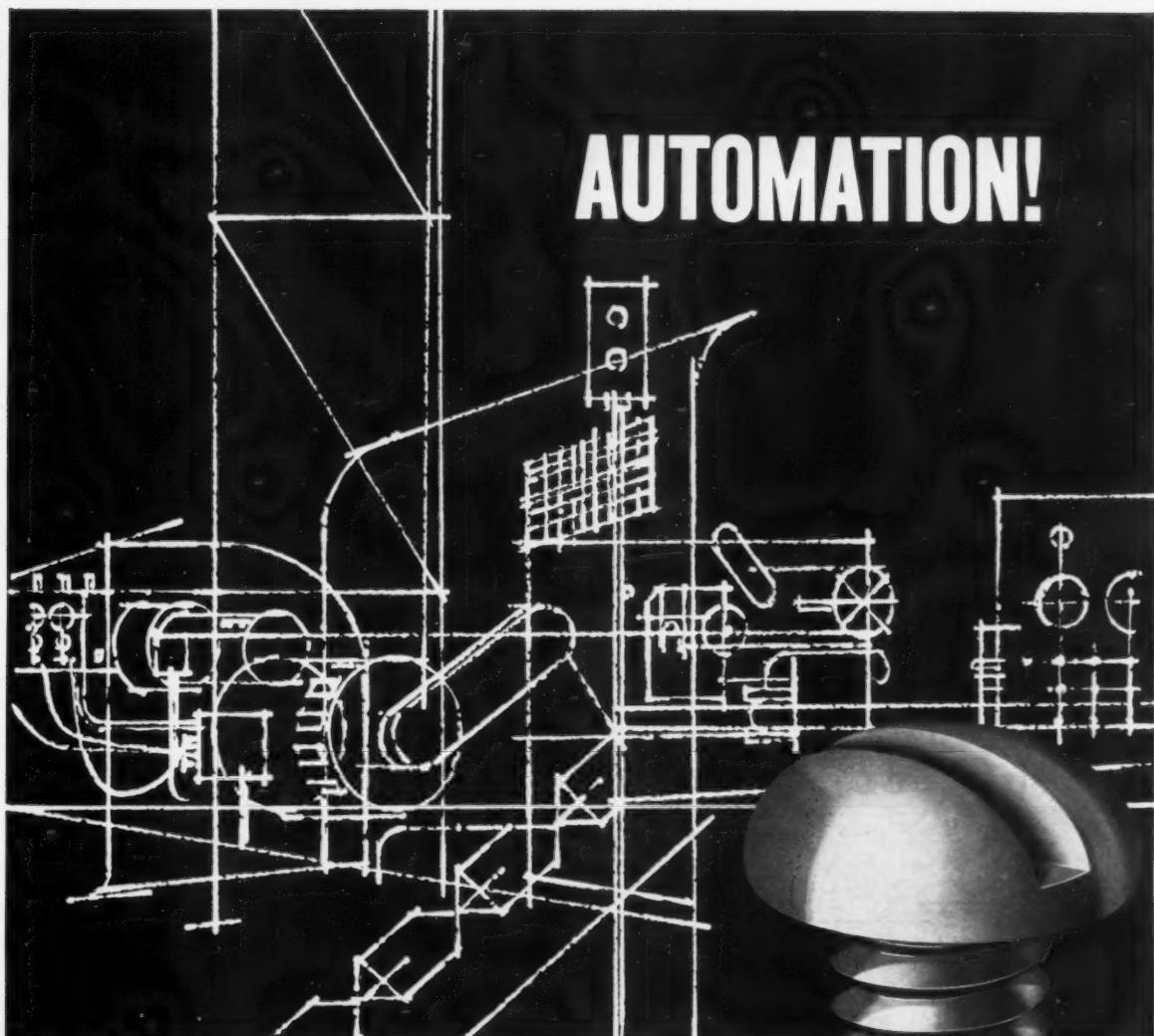
Here is a new New Britain bar machine with the ruggedness, power, speed and versatility to shed new light on your profit picture. Where you have bar work that now requires more than one machine, it may be practical to eliminate costly finishing operations by doing the whole job on a New Britain Model 62. Ask your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



## old methods can't compete

If you do *any* turning you should investigate the New Britain +GF+ line of copy turning lathes—whether your work calls for sustained production or short runs demanding quick setups. It turns tapers and complicated contours with the same setup used for simple O.D.'s. No need for expensive form tools. Let us demonstrate this completely different approach to turning in a color motion picture demonstration at your desk.





# AUTOMATION!

**P-K®** screws can help you  
convert to automation!

Dependable fastening is a "must" for high-speed automation. On hundreds of automatic assembly lines, PARKER-KALON Self-tapping Screws have proved their worth—eliminating stoppages, reducing parts spoilage, rejects, and those hidden weaknesses which inspection sometimes can overlook. With P-K fasteners you can be sure of consistent uniformity, because every P-K screw is slotted, headed, threaded and hardened to rigid dimensional and quality standards.

Talk with a P-K Assembly Engineer. He will show you why manufacturers converting to automation agree . . . "If it's P-K, it's O-K!"

**PARKER-KALON DIVISION, General American Transportation Corporation**  
Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails,  
Wing Nuts and Thumb Screws

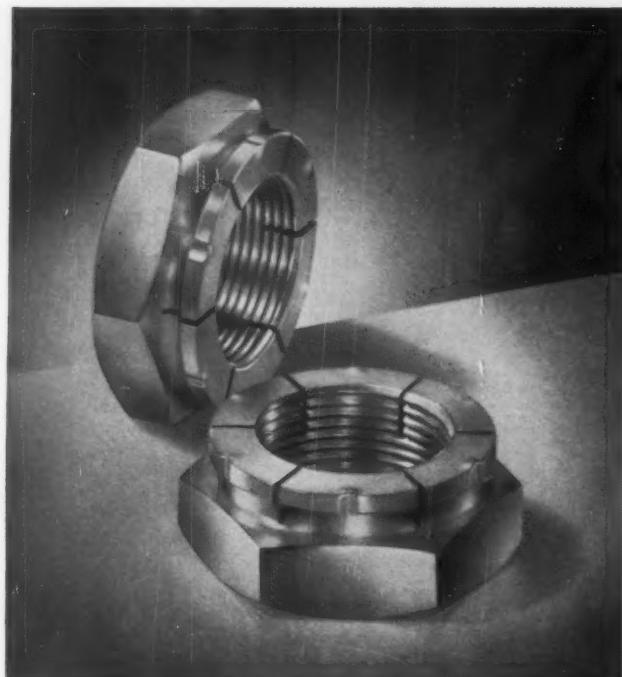
**PARKER-KALON®**  
fasteners

Sold Everywhere Through Leading Industrial Distributors Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—95

# Flexloc thin nuts save space, weight and production time



SPECIFICATIONS  
FLEXLOC THIN NUTS



NATIONAL COARSE THREAD—U.S.S.

| SIZE    | A<br>INCHES | H<br>INCHES | WIDTH<br>ACROSS<br>CORNERS | WEIGHT PER<br>1000 NUTS |
|---------|-------------|-------------|----------------------------|-------------------------|
| 6-32    | .312        | .125        | .361                       | 1.8                     |
| 8-32    | .344        | .172        | .397                       | 2.8                     |
| 10-24   | .375        | .172        | .433                       | 3.3                     |
| 1/4-20  | .438        | .203        | .505                       | 5.4                     |
| 5/16-18 | .563        | .250        | .649                       | 11.6                    |
| 5/16-16 | .625        | .265        | .722                       | 14.9                    |
| 7/16-14 | .750        | .312        | .866                       | 24.9                    |
| 1/2-13  | .813        | .312        | .938                       | 28.4                    |
| 9/16-12 | .875        | .359        | 1.010                      | 36.1                    |
| 5/8-11  | 1.000       | .391        | 1.155                      | 54.1                    |
| 3/4-10  | 1.125       | .406        | 1.299                      | 69.2                    |
| 7/8-9   | 1.312       | .469        | 1.516                      | 107.5                   |
| 1-8     | 1.500       | .563        | 1.732                      | 171.6                   |

NATIONAL FINE THREAD—S.A.E.

| SIZE      | A<br>INCHES | H<br>INCHES | WIDTH<br>ACROSS<br>CORNERS | WEIGHT PER<br>1000 NUTS |
|-----------|-------------|-------------|----------------------------|-------------------------|
| 6-40      | .312        | .125        | .361                       | 1.8                     |
| 8-36      | .344        | .172        | .397                       | 2.8                     |
| 10-32     | .375        | .172        | .433                       | 3.3                     |
| 1/4-28    | .438        | .203        | .505                       | 5.4                     |
| 5/16-24   | .500        | .250        | .577                       | 8.7                     |
| 5/16-24   | .563        | .266        | .649                       | 11.5                    |
| 5/16-20   | .625        | .312        | .722                       | 14.9                    |
| 5/16-20   | .750        | .312        | .866                       | 21.7                    |
| 9/16-18   | .875        | .359        | 1.010                      | 36.2                    |
| 5/8-18    | .938        | .391        | 1.082                      | 42.4                    |
| 5/16-16   | 1.063       | .406        | 1.227                      | 54.5                    |
| 7/16-14   | 1.250       | .469        | 1.443                      | 84.6                    |
| 1-14      | 1.438       | .563        | 1.660                      | 136.3                   |
| 1 1/4-12* | 1.625       | .625        | 1.876                      | 193.5                   |
| 1 1/4-12* | 1.813       | .750        | 2.093                      | 296.0                   |
| 1 1/4-12* | 2.000       | .812        | 2.309                      | 389.0                   |
| 1 1/4-12* | 2.187       | .875        | 2.526                      | 498.0                   |

\*Steel only (plain or cadmium plated) in stock sizes.

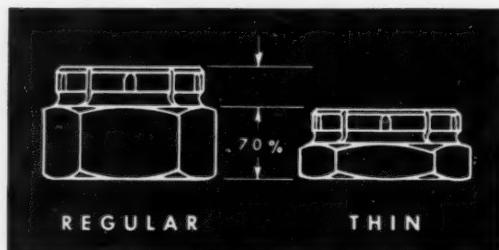
**Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools**

Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.



**FLEXLOC thin nuts are 30% lower** than regular height locknuts. There is a corresponding saving in weight. In sizes through  $\frac{5}{16}$  in., thin FLEXLOCs meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

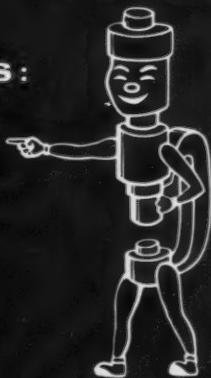
Standard FLEXLOC self-locking thin nuts are available in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.

**FLEXLOC LOCKNUT DIVISION** **SPS**

JENKINTOWN PENNSYLVANIA

**PRECISION PETE SAYS:**

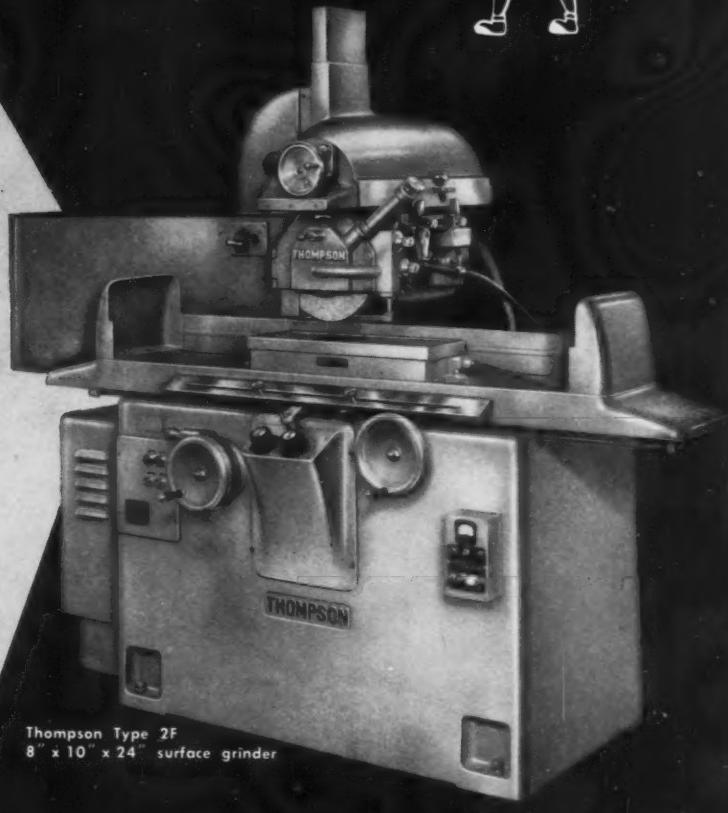


**COOLANT  
THRU THE  
WHEEL . . .**

Only Thompson  
Type 2F Grinder  
has all three  
available . . .

**2**

**... COOLANT  
EXTERNALLY ON  
THE WORK . . .**



Thompson Type 2F  
8" x 10" x 24" surface grinder

**... AND  
"IN POSITION"  
WHEEL  
TRUING**

**3**

MANUFACTURERS  
OF THE WORLD'S  
MOST COMPLETE LINE  
OF SURFACE GRINDERS

WRITE TODAY FOR DESCRIPTIVE DATA

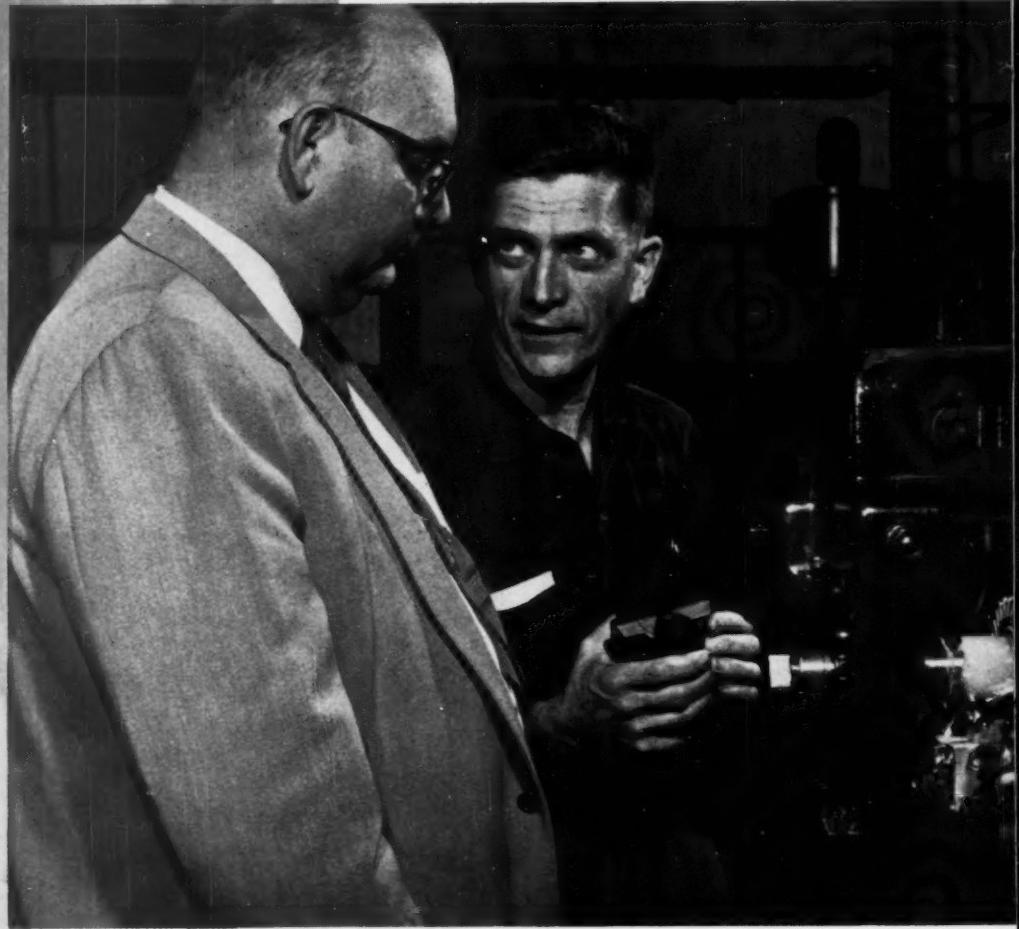
**THE THOMPSON GRINDER COMPANY  
SPRINGFIELD, OHIO**

**Thompson**  
**SURFACE**  
**Grinders**

Copyright 1956 The Thompson Grinder Company

## Bit manufacturer bites off

George P. Gaunt (right) shop superintendent shows rock bit to Joseph D. Grigas, industrial lubrication specialist at Standard Oil. Joe recommended switch to SUPERLA Soluble Oil. Joe is well qualified to make such recommendations. He has 13 years experience in such work, has a degree in engineering from Illinois Institute of Technology and is a graduate of the Standard Oil Sales Engineering School.



Brunner & Lay carbide insert rock bits are made from high chrome-nickel-moly steel, Rockwell 18C-22C hardness.

# 20% production increase

*SUPERLA Soluble Oil plus technical service add up to improved product output at Chicago Brunner & Lay Rok-Bit Corp.*

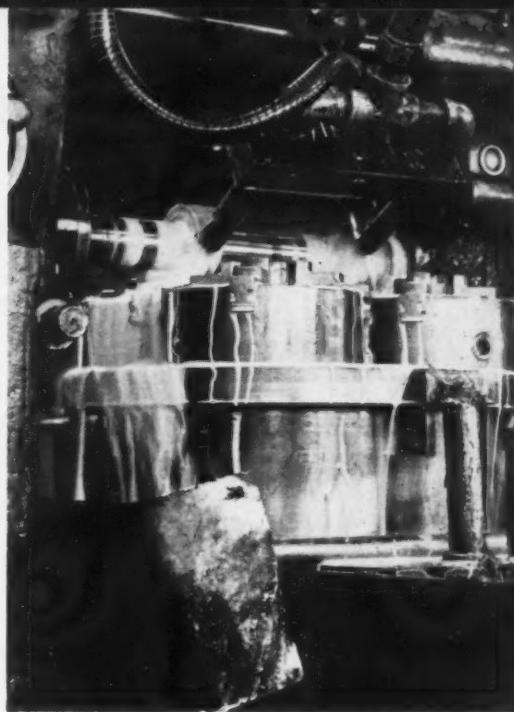
SUPERLA Soluble Oil, which is now being used by Chicago Brunner & Lay Rok-Bit Corp., has solved a lot of milling machine operating problems for the Company. Soluble oils formerly used separated out of emulsion and turned rancid in use. Oil circulating lines plugged repeatedly. The plant's production rate was not up to capacity because of frequent shut downs for cleaning of machines and for unplugging of oil lines.

**On the advice** of Joe Grigas, Standard Oil industrial lubrication specialist, the Company thoroughly cleaned the machines, then converted them to SUPERLA using the soluble oil at 10:1 dilution.

**This is how** the change-over worked out. *Production was increased 20%*. Machine down time was substantially reduced. The Company was sufficiently pleased with the performance of SUPERLA Soluble Oil in milling machines to convert two grinding machines to this oil. Results obtained on the grinding machines: excellent wheel life, good finish and rust protection of work and machines.

SUPERLA Soluble Oil emulsifies readily with all types of water. It is a stable oil and forms stable emulsions. It does not tend to develop objectionable odors in use nor is it injurious to men, work or machines. SUPERLA Soluble Oil gives good tool life and prevents rust.

**Get the facts** about SUPERLA Soluble Oil. Your Standard Oil industrial lubrication specialist has them. In any of the 15 Midwest or Rocky Mountain states, one of these lubrication specialists is nearby. Call the one nearest you. Or write Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.



Milled slots up to  $\frac{7}{8}$ " wide and 1" deep are made in this special alloy Rok Bit Steel in one cut. All of these milling machines use SUPERLA Soluble Oil exclusively.

## Quick facts about

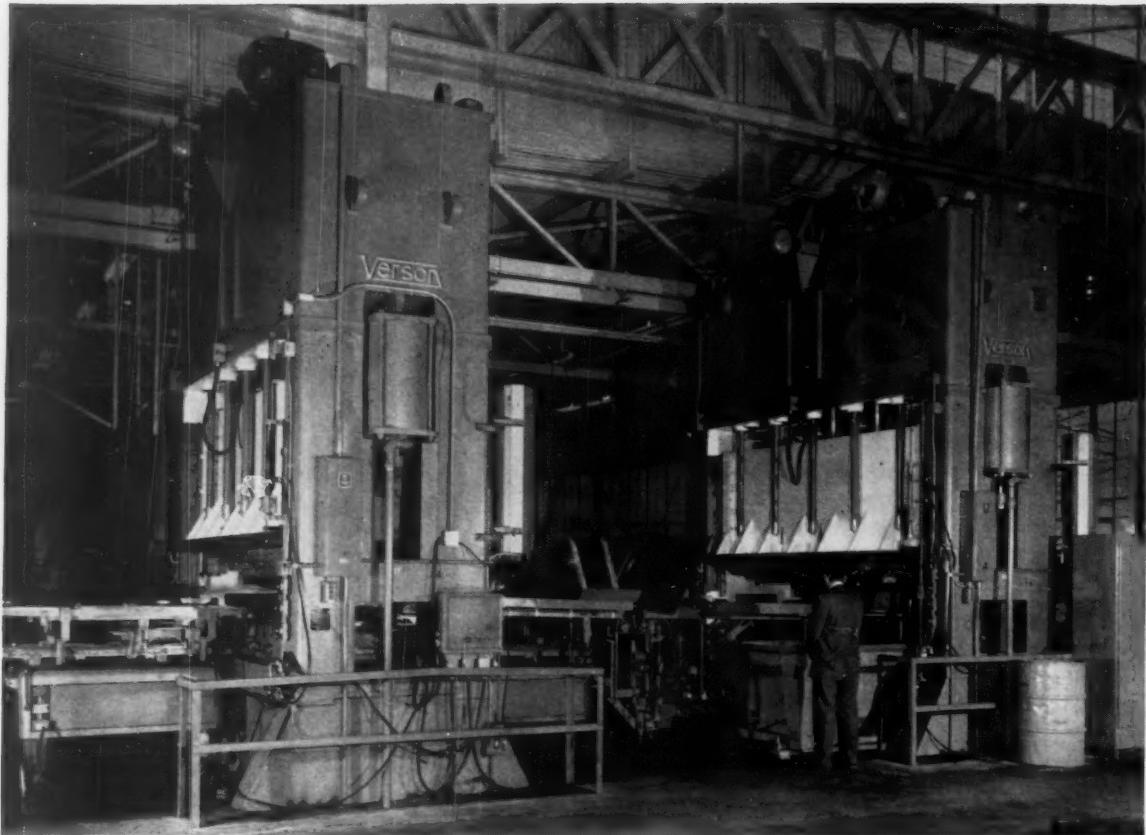
### **SUPERLA Soluble Oil**

- Emulsifies readily
- Forms stable emulsion
- Doesn't turn rancid
- Economical. Requires low emulsion concentrations
- Prevents rusting
- Non-injurious to men, machines, work
- Gives good tool life



**STANDARD OIL COMPANY** (Indiana)





## Two 400 ton **Verson** Presses perform as one production unit to manufacture automatic dryer bodies



Catalog G-56 describes the entire Verson line and gives design details and specifications. Write for your copy, today.

The two 400 ton Verson eccentric presses shown above, integrated with automatic handling equipment and controlled by one operator, perform as a single production unit in the manufacture of automatic clothes dryer bodies for a leading appliance manufacturer. The press on the left blanks and forms the dryer body and draws the front face with door opening. The parts then move automatically to the press on the right for flanging and punching operations. Speed is 14 strokes per minute.

Verson presses are engineered to become an integral part of the production process in which they are used. If you make stampings of any kind, this approach to your problems can mean big savings. Send an outline of your requirements today and put real production know-how to work for you!

A Verson Press for every job from 60 tons up.



ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

**VERSON ALLSTEEL PRESS CO.**

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

# NOW for heavy duty grinding . . .

you can have the fast  
cutting action of a  
softer grade with long  
life of a hard wheel

## SIMONDS New IL BOND

Try

SIMONDS  
ABRASIVE CO.

SNAGGING  
WHEELS

with New IL BOND



It's in the wheel mix! Special chemicals and compounds added to conventional resinoid bonds provide an internal lubricant which increases the abrasive cutting action—yet retains long wheel life.

IL bond gives a distinctly different grinding action on semi-automatic and regular swing frame grinders, on floor stands and portables. IL bond in harder grade will give longer life if your present cutting rate is satisfactory, and IL bond in the same grade will increase cutting action if your present wheel life is satisfactory. Write for descriptive bulletin.

Available with  
Red Streak Flanges  
— for metal to metal  
fit on mounting equipment  
— another Simonds  
Abrasive exclusive.

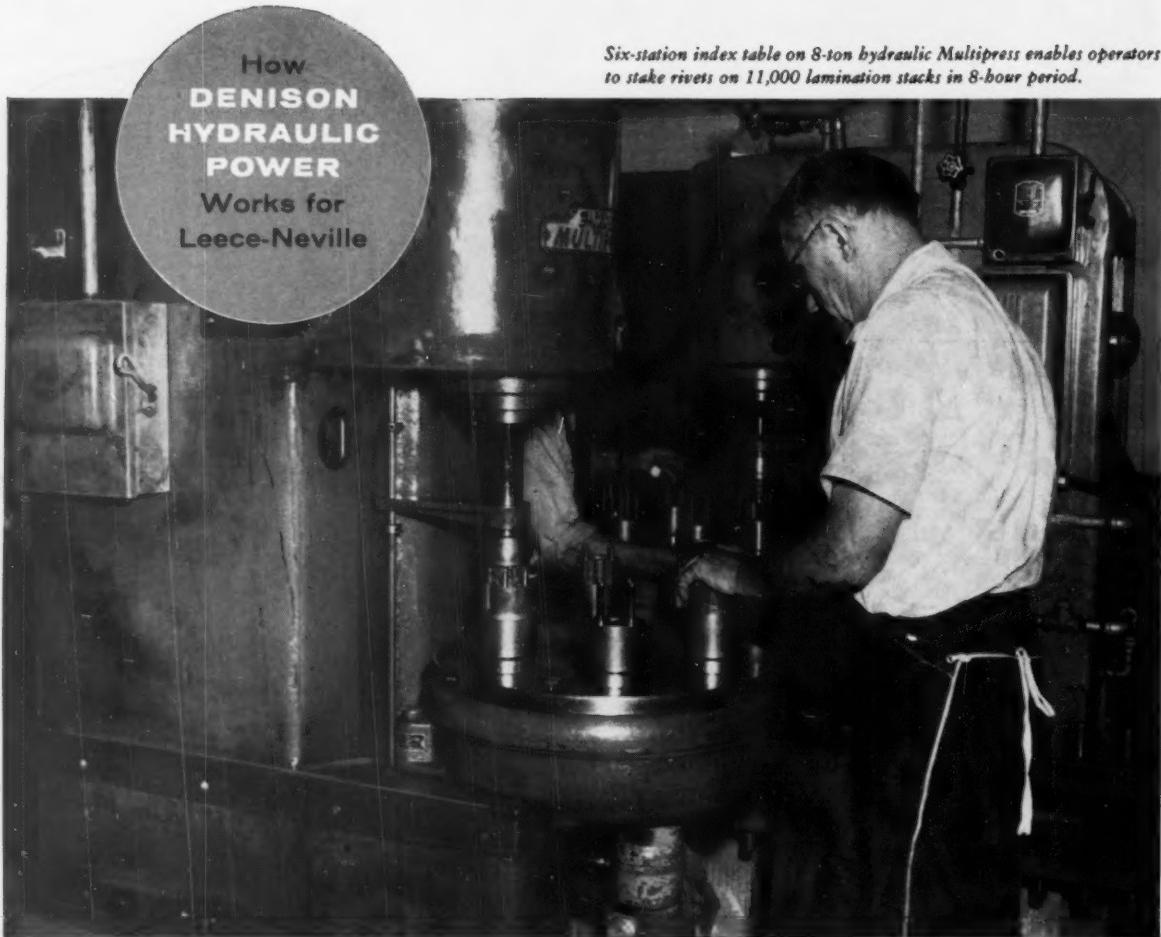
CALL YOUR SIMONDS  
DISTRIBUTOR  
  
LOCAL STOCK  
FAST SERVICE

**SIMONDS ABRASIVE COMPANY**

Tacony & Fraley Sts., Philadelphia 37, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

BRANCH WAREHOUSES: BOSTON, DETROIT, CHICAGO, LOS ANGELES, SAN FRANCISCO, PORTLAND



Six-station index table on 8-ton hydraulic Multipress enables operators to stake rivets on 11,000 lamination stacks in 8-hour period.

## MULTIPRESS® simplifies small motor production



4,560 brush riggings are assembled every 8 hours in this Multipress operation which eliminates bottlenecks at strategic points in the production process.

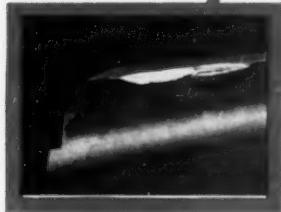
At the Leece-Neville Company, Cleveland, Ohio, fractional horsepower motors are produced around-the-clock. With the help of Denison hydraulic Multipress, automated methods have been incorporated to speed and simplify production.

An example is the use of two 8-ton presses for staking rivets on lamination stacks. In other applications, Multipress assembles brush riggings and armature cores, and notches motor housings. In all of these operations, precision control plus savings in time, lost motion and scrap make the investment in Multipress highly profitable.

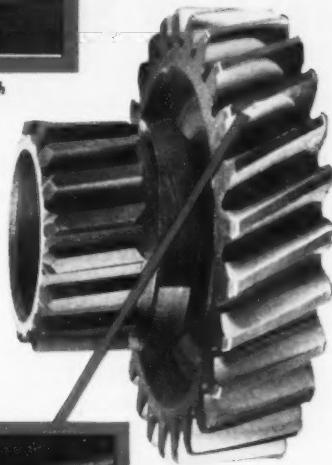
Denison engineers are specialists at helping your company improve product quality. Write Denison Engineering Division, American Brake Shoe Co., 1244 Dublin Road, Columbus 16, Ohio.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

 **DENISON**  
**HydrOILics**



NICKED GEAR TOOTH



SAME GEAR TOOTH  
AFTER HONING

# RED RING HARD GEAR HONING

PRODUCES  
QUIET  
GEARS

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS  
ORIGINATORS OF ROTARY SHAVING  
AND ELLIPTICAL TOOTH FORM

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN • DETROIT 13, MICHIGAN

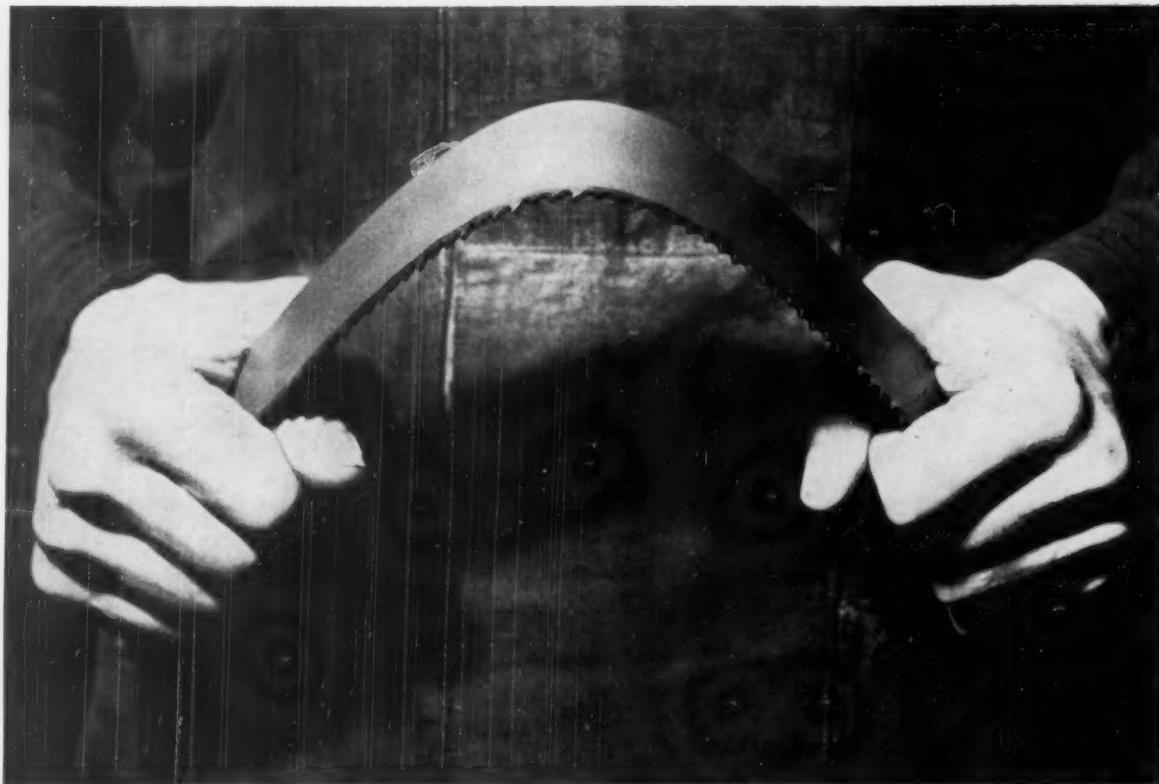
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—103



## **THIS is No Ordinary Power Hack Saw Blade**

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its per-

formance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—it is *unbreakable*.

Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

B-1120

Write for latest cutting tool Bulletin and  
the name of your nearest MARVEL Distributor

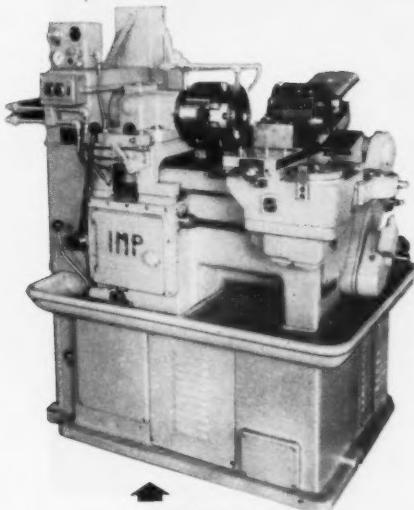


**ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.**

# MACHINE OF THE MONTH

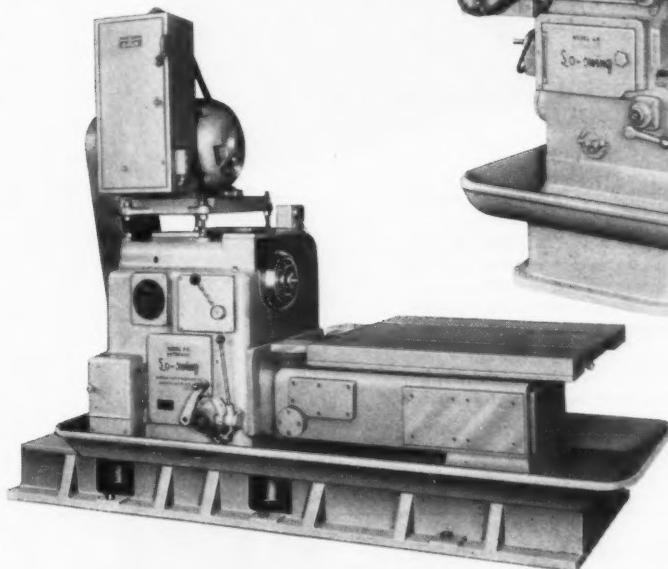
PREPARED BY THE SENECA FALLS MACHINE CO. "THE So-swing PEOPLE" SENECA FALLS, NEW YORK

## NEW PLATEN-TYPE AUTOMATIC LATHES CUT BORING, FACING AND TURNING COSTS



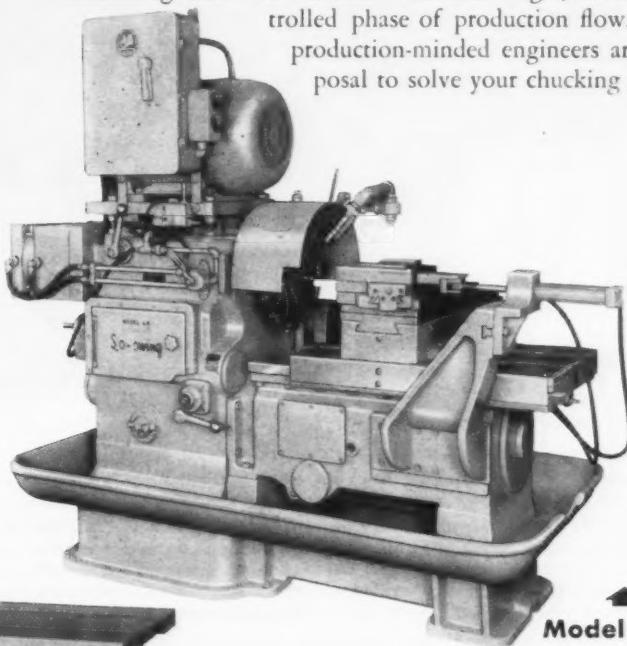
Model "N"

Swing Over Platen . . . 11"  
H. P. Capacity . . . . . 5



Model "LN"

Swing Over Platen . . . 18"  
H. P. Capacity . . . . . 20



Model "AN"

Swing Over Platen . . . 24"  
H. P. Capacity . . . . . 40

**SENECA FALLS PLATEN-TYPE, CAM-OPERATED  
AUTOMATIC LATHES**

The NEW Seneca Falls Platen Type Automatic Lathes have been designed principally as chucking machines adaptable to a wide variety of work requiring large swing capacity, high spindle speeds, multiple tooling and fast cycling operation.

The platens have cam operated longitudinal and cross feeds and may be equipped with angular feeding slides and other special attachments suitable for customer's work.

All three types of machines may be equipped with Seneca Falls Automatic Loading and Transfer Equipment which provides means to extend automaticity to individual machines or through a series of successive, though dissimilar, operations to combine work loading, machining and work transfer into one single, automatically controlled phase of production flow. Seneca Falls

production-minded engineers are at your disposal to solve your chucking problems.

# BATH PRESSES can TAKE IT... Around the Clock!



The Fort Steuben Metal Products Co.,  
Follansbee, West Virginia specializes  
in the fabricating of anything in the  
metal shelving line.



Mr. Albert W. Robinson, Vice President of the Fort Steuben Metal Products Company  
has this to say about Bath Presses:

"Here at Fort Steuben we are more than satisfied with the way Cyril Bath Presses have demonstrated their ability to take it. Operating as we do, sometimes around the clock to keep up with demand for our shelving, we require dependable, rugged equipment. This ruggedness, coupled with large bed area for dollars expended, plus ease of operation and maintenance makes Cyril Bath Presses ideal."

Catalogs are available, without obligation, covering both The Cyril Bath Power Press Brake and P. T. Press line . . . this literature covers important information regarding the features which make BATH Presses your best buy . . . and ask for the Power Press Brake Die Catalog too!

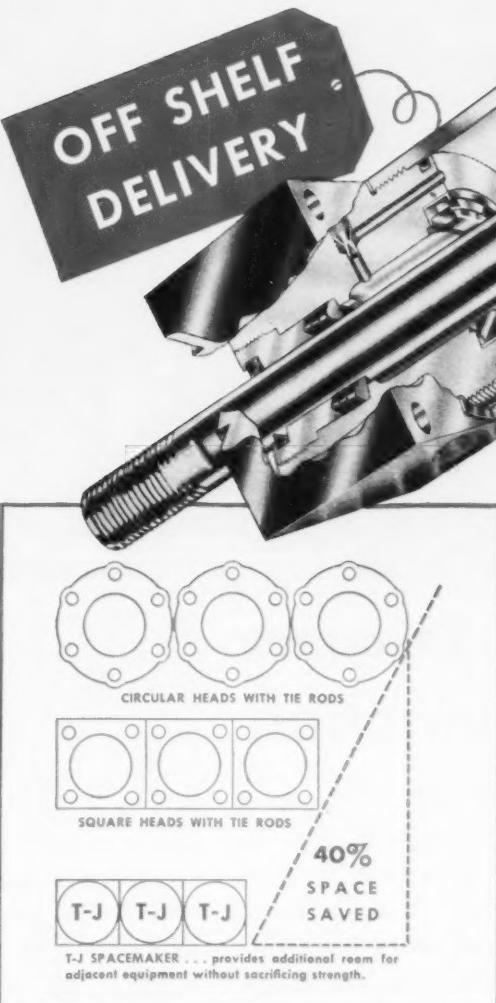


THE CYRIL  
**BATH**  
COMPANY

32324 AURORA ROAD • SOLON, OHIO  
(LOCATED IN THE GREATER CLEVELAND AREA)  
Manufacturers of Radial Draw Formers • Dies • Tools • Press  
Brakes • Tangent Bending Sequence Presses • Press Type  
Brakes • Special Machines

# Saves 40% Space! STRONGER, TOO

Than Outmoded  
Tie Rod Cylinders!



**NEW LITERATURE... send today  
for new Bulletin with complete  
details of Spacemaker line.**

For more information fill in page number on Inquiry Card, on page 233

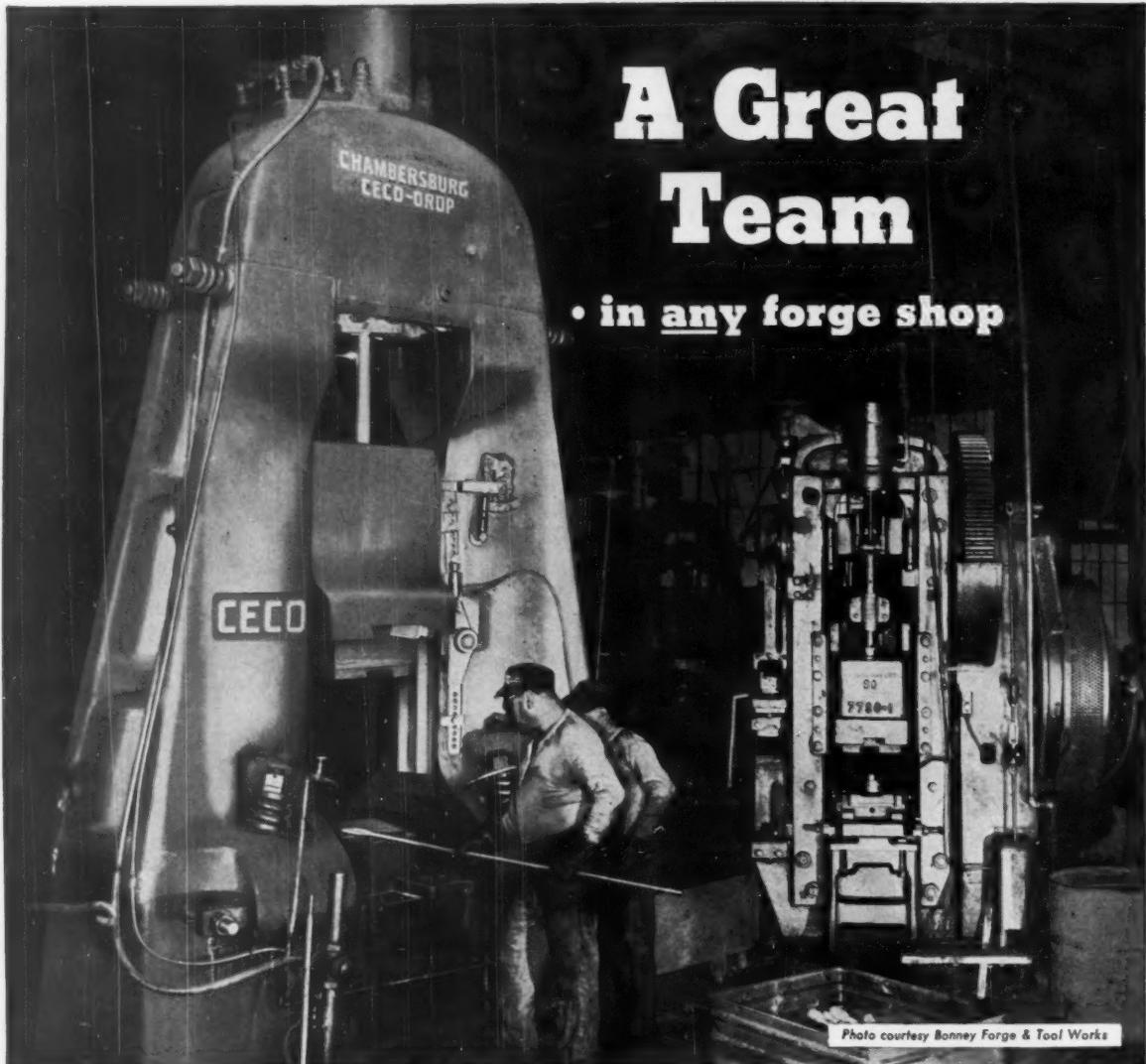
MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION



**TOMKINS-JOHNSON**

RIVETERS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

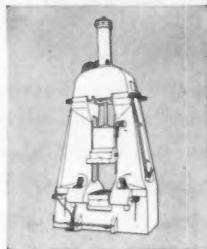
MACHINERY, January, 1957—107



# A Great Team

• in any forge shop

Photo courtesy Bonney Forge & Tool Works



**CHAMBERSBURG  
CECO-DROP**

- Piston-lift • Gravity drop
- Costs less to operate
- Forges more minutes per hour
- Forgings made faster
- Operation is easier and safer
- Maintenance is cheaper
- Full stroke or short stroke without interruption
- Over 400 in service in over 100 forge shops

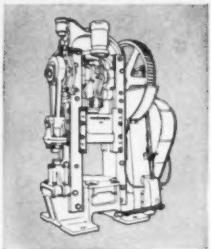
## Ceco-Drop and Trimmer • • for top production

When the chips are down, it is continuous, trouble-free, quality production that puts you ahead of competition. That fact explains why the Ceco-Drop (in combination with the "indestructible" Chambersburg Trimmer) has become in nine short years, the standard gravity drop hammer of the forging industry.

*Write for descriptive Bulletins*

**CHAMBERSBURG ENGINEERING COMPANY  
CHAMBERSBURG PENNSYLVANIA**

— ALSO BUILDERS OF THE IMPACTER —



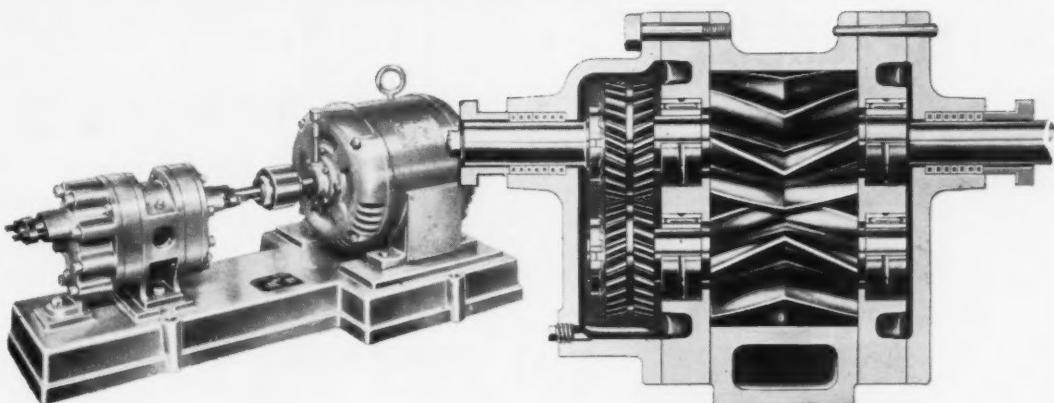
**CHAMBERSBURG  
FORGED STEEL SIDE  
TRIMMING PRESS**

- Exceptional strength
- Jam-proof. Functions perfectly after stall-test
- Uses minimum floor space
- Accessible front and back
- Friction-slip Flywheel
- Interlocking forged steel side construction
- Low power consumption
- Safe
- Single or Double Crank

# ORANGE Cage Type NEEDLE BEARINGS

meet strict design and operating requirements

## in Sier-Bath "Gearex"® Pumps



Sier-Bath "Gearex" Pumps (Internal Bearing Type) handle oils and lubricating materials from thin to heavy viscosities, in volumes up to 550 gpm. and pressures to 250 psi. "Gearex" Pumps are distinguished for compactness and high capacity—cool, quiet, vibration-less operation—dependability under severest 24-hour-a-day running.

Cutaway shows 4 Orange Cage Type Needle

Bearings mounted on shafts of timing gears and double helical rotors. All parts and clearances are built to close tolerance and must be maintained through years of operation. The Orange cage-type bearings eliminate possibility of roller skewing—run smoothly, quietly—carry the loads in very small space—have been used successfully for eight years in this installation.

## Non-skewing rollers—high capacity—small space provide answer to many bearing design problems

**D**on't lose the opportunity to compact your designs with the high load-to-space ratio of needle bearings because of specific or unusual operating conditions.

The unique advantages of Orange Cage Type Needle Bearings have broadened the use of needle bearings—opened many applications hitherto unsuited to conventional types.

With the Orange cage design, rollers are permanently aligned. The rollers can not skew. True

running is assured at relatively high speeds and in any position—horizontal, vertical, tilted or overhung mountings. They are less affected by misaligned mounting or uneven loading. Operation is extremely quiet, even and trouble-free.

Standard sizes from  $\frac{1}{2}$ " to 8" shaft diameters, with stocks and engineering service in all leading industrial centers. Write for 40-page Engineering Manual M-56 showing details and dimensions.



**ORANGE**  
**ROLLER BEARINGS**

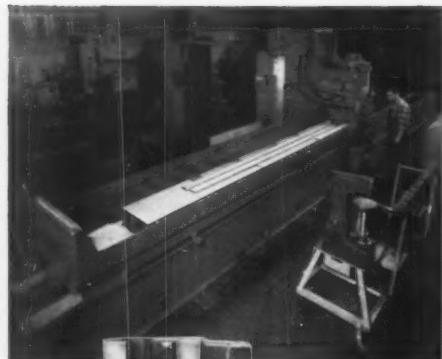
ORANGE ROLLER BEARING CO., Inc.  
552 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings  
Journal Roller Bearings — Thrust Roller Bearings  
Cam Followers



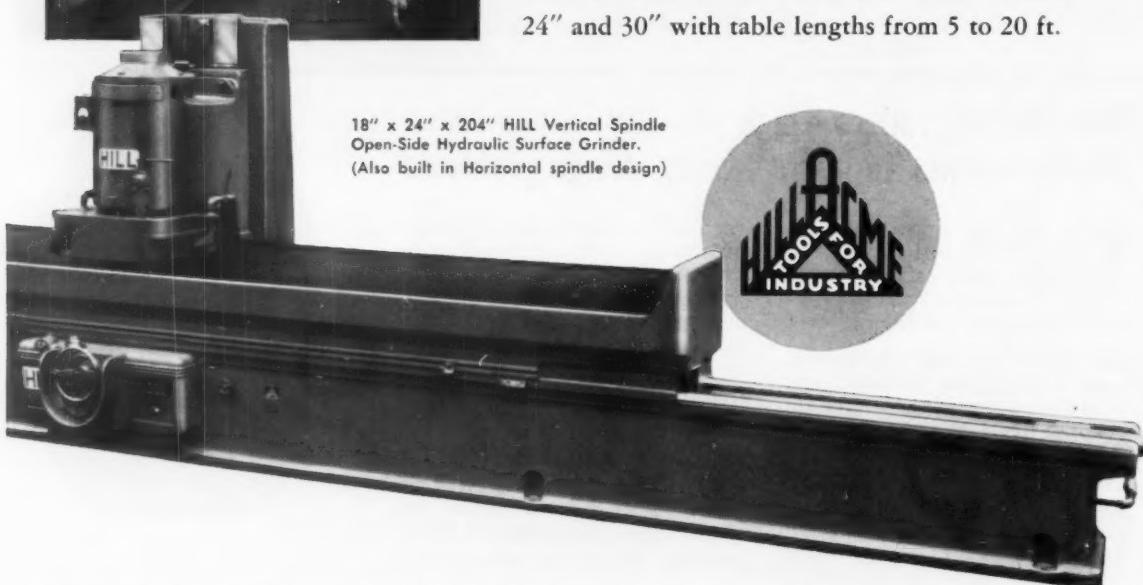
# EVERY HEAVY DUTY SURFACE GRINDER SHOULD HAVE:

- Open-side Accessibility
- 100% Hydraulic Table Drive
- Built-in Spindle Motor
- Centralized Controls
- Low Pressure Hydraulic System
- One-Shot Lubrication System
- Adequate Safety Devices



## BUT THEY DON'T—

So GET A HILL with ALL the above features *plus* many other design improvements which insure rapid stock removal and accurate grinding of flat surfaces within the periphery of the grinding wheel. HILL Vertical Spindle grinders are built in table widths of 18", 24" and 30" with table lengths from 5 to 20 ft.



18" x 24" x 204" HILL Vertical Spindle  
Open-Side Hydraulic Surface Grinder.  
(Also built in Horizontal spindle design)

## THE HILL ACME COMPANY

1201 WEST 65th STREET . . . CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING  
TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES



## **Imagine! Presses where dies are changed the way you turn on the light!**

Here's an arresting new method to put more productive hours into a working day. Clearing moving bolster presses shrink the hours required from changing jobs on a press, or a press line, to minutes. Push-button die setting reduces downtime in direct proportion to the amount of job changing required in a plant—saving up to 50% of lost production hours in some instances.

These new Clearing presses are designed with a bolster that is rolled from left to right through the die area. Dies for the next job are set up outside the press during a press run. When the current job is completed, a touch of the control button powers the new dies into

position under the slide. Power actuated clamps release the old dies, clamp in the new—and with proper slide adjustment (also powered) the new job is ready to go.

Clearing engineers have designed these presses to combine with other bold new ideas for increasing press productivity. Moving bolsters will work, for example, with Transflex feeds. They may also be designed on either top drive or bottom drive machines. If this unusual new idea in press design appeals to you, remember it is only one of many Clearing innovations that can help you boost manufacturing output. Call on a Clearing engineer to discuss these ideas. There'll be no obligation, of course.

### **CLEARING PRESSES**

THE WAY TO EFFICIENT MASS PRODUCTION

**CLEARING MACHINE CORPORATION**

6499 WEST 65th STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT, HAMILTON, OHIO

Division of U. S. INDUSTRIES, INC. 



# U. S. Steel Supply Provides Customers with SMOOTH ACCURATE SHEARING

One Shear Takes the Place of Two or Three



No. 12E-12 Steelweld Shear at U. S. Steel Supply, Seattle, Washington, rated for steel plate 12' x  $\frac{3}{4}$ ". Being cut in photo is a plate, size 7' x 30' x  $\frac{3}{4}$ ". With hand crank on right end, this machine can be adjusted in a few seconds to have exactly the right knife clearance to obtain the finest cut for any thickness. To make this adjustment on guillotine-type shears usually requires several hours.

MANY steel warehouses have two and often three shears, one of a  $\frac{1}{4}$ " capacity for lighter thicknesses, another of  $\frac{1}{2}$ " capacity for cutting  $\frac{1}{4}$ " to  $\frac{1}{2}$ " material, and a third with 1" capacity for thicknesses over  $\frac{1}{2}$ " and up to 1". At some of its warehouses, U. S. Steel Supply uses only one machine for cutting the various thicknesses—a Steelweld Pivoted-Blade Shear.

One machine takes the place of two or three,

because it is so easy to adjust the knife clearance required to obtain the best cuts for different thicknesses, which can range from lightest gauge metal to the heaviest plate within the capacity of the shear.

Thus, the investment in shearing equipment is kept low, yet the customers of U. S. Steel Supply are always assured of straight, smooth, accurately cut metal on every order.



GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5453 East 282 Street, Wickliffe, Ohio

**STEELWELD**  **PIVOTED BLADE** **SHEARS**

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.



Write for your free copy of this important booklet today!



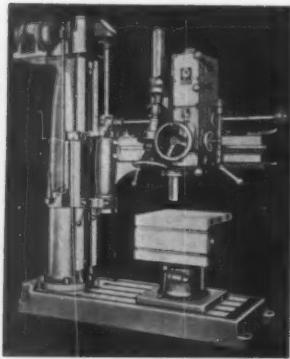
# Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

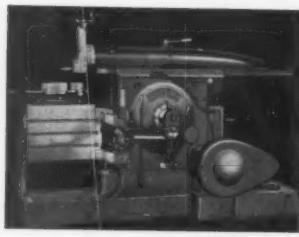
For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—113

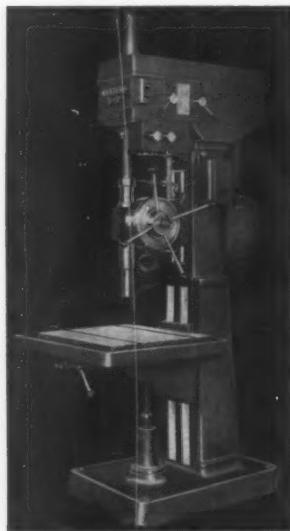
**CHARD** Multi-Speed Quick Change Engine Lathe—precision Timken Bearing Equipped—Made 16", 18" and 20" Sizes—8 or 12 Speeds—Twin Disc Clutch.



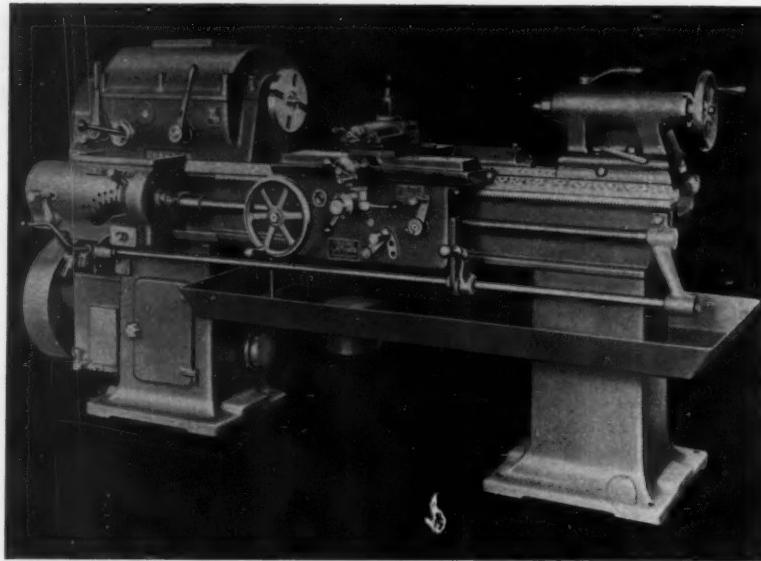
**WESTERN RADIAL DRILLS**  
—Heavy Duty, 3 to 8 ft., 16 or 32 speeds. High Speed, 3 to 6 ft., 6, 9, 12 or 18 speeds.



**STEPTOE SHAPERS** — 14" to 24" Heavy Duty; 12" and 15" High Speed, up to 200 strokes per minute.



**WESTERN UPRIGHT DRILLS**  
—Single or multiple spindle; 18 speeds; 9 feeds; all geared; up to 2½" capacity.



# THE BIG 4

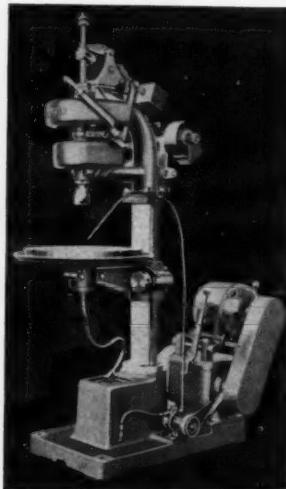
"RELIABLE—SINCE 1895"

## WESTERN LINE

The gearbox of the CHARD MULTI-SPEED LATHE contains exclusive features which contribute to the superiority of performance in marked degree over other lathes. It is located at the head-end cabinet leg and contains four of the changes of speed, the start-stop clutch mechanism, spindle brake, and silent chain sprocket for driving direct to the spindle in the headstock above. Segregating most of the high speed gearing close to the floor line and away from the main spindle serves to isolate vibration, reduce stresses in the headstock casting and add to the general stability of the machine. Single or double back-gear headstocks are available. The spindle is mounted on four Timken tapered precision roller bearings. All speed control is from the headstock position. Complete line of optional equipment.

For more information on these and other machines in the Big 4 line write for catalogs. Specify sizes required.

**GARVIN AUTOMATIC TAPPERS**—Up to 3" pipe tap capacity; four spindle speeds.



MANUFACTURED BY

**WESTERN MACHINE TOOL WORKS**  
**HOLLAND, MICHIGAN, U.S.A.**

How a better precision-fit Guide Pin Bushing\*  
is made in less time with

## SHELBY SEAMLESS MECHANICAL TUBING



Here is another manufacturer that is turning out a better product in less time by using Shelby Seamless Steel Tubing.

The product, a wring-fit bushing, makes possible a truly precision die set, which permits closer working tolerances and extends the life of the dies to a degree never before thought possible. The bushing itself is harder, stronger, more uniform, longer lasting and better fitting.

When Shelby Seamless Tubing is used, no boring is necessary—the hole is already there. It offers more, however, than just a pre-bored hole. It combines to an exceptional degree the qualities of strength, uniformity, and dimensional accuracy. These advantages, coupled with the workability and excellent machining properties of Shelby Seamless, make it the ideal material for critical mechanical applications like this.

Available in a wide range of diameters, wall thicknesses, various shapes and steel analyses, Shelby Seamless Mechanical Tubing is produced to exacting standards by the world's largest manufacturer of tubular steel products. Get in touch with our engineers if you would like help in applying Shelby Seamless to your specifications.

\*Manufacturer's name on request.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS

UNITED STATES STEEL EXPORT COMPANY, NEW YORK



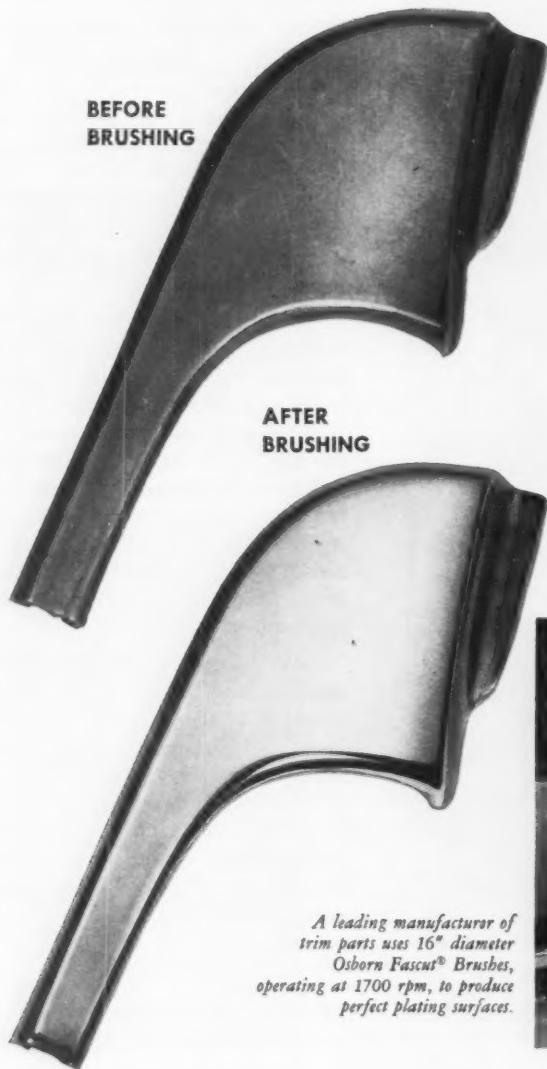
## SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL



BRUSHING METHODS worthy of your confidence

## Start of a flawless finish

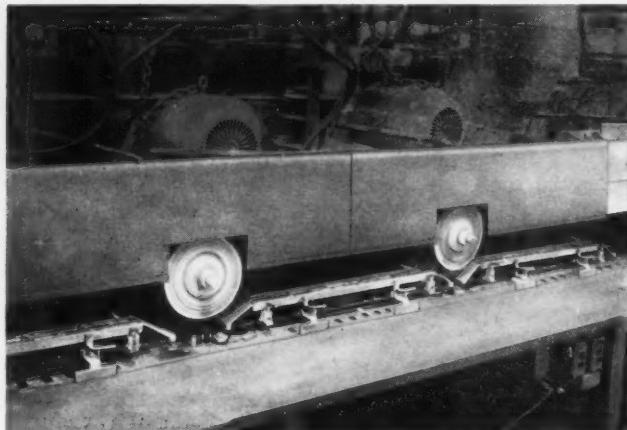


A leading manufacturer of trim parts uses 16" diameter Osborn Fascut® Brushes, operating at 1700 rpm, to produce perfect plating surfaces.

THE bright finish on trim parts that "dress up" thousands of products must start with a perfect, unmarred surface prior to final buffing and plating.

Osborn power-brushing has proven the ideal production method for removing draw marks, blending imperfections as an essential preliminary step, before buffing.

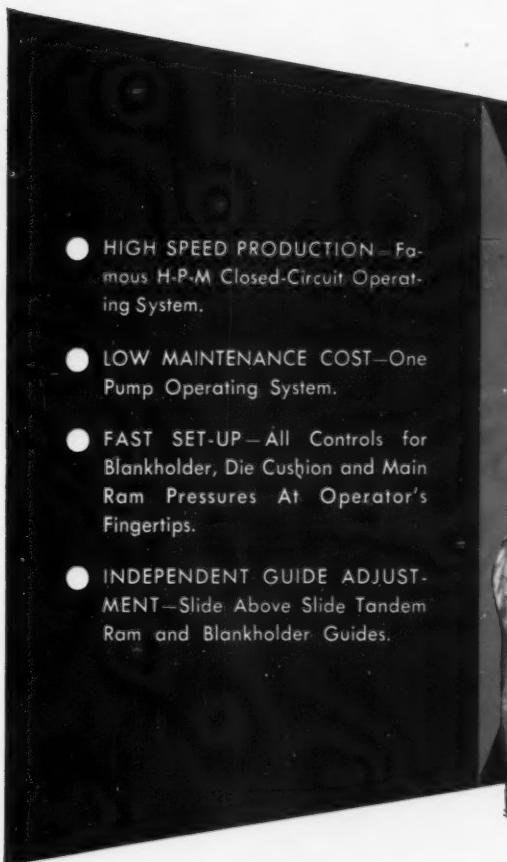
These outstanding results are another reason why Osborn power brushing has gained industry's confidence. An **Osborn Brushing Analysis**, made at no obligation, will show how you can benefit from this advanced finishing method. Write *The Osborn Manufacturing Company, Dept. D-49, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



# Osborn Brushes

# here's why H-P-Ms PAY OFF

**H-P-M 3-in-1  
Blankholder Presses  
Give You More  
Per Dollar Invested**



- HIGH SPEED PRODUCTION—Famous H-P-M Closed-Circuit Operating System.
- LOW MAINTENANCE COST—One Pump Operating System.
- FAST SET-UP—All Controls for Blankholder, Die Cushion and Main Ram Pressures At Operator's Fingertips.
- INDEPENDENT GUIDE ADJUSTMENT—Slide Above Slide Tandem Ram and Blankholder Guides.

#### For Single Action Jobs

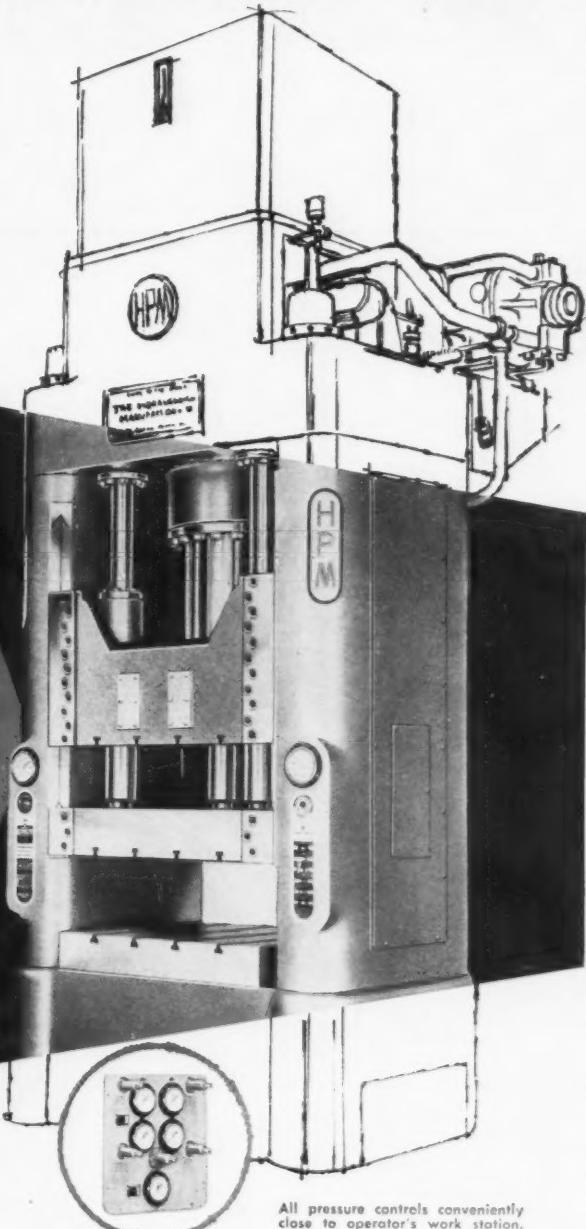
blankholder locks to face of main slide. Only main ram operates. Die cushion is idle.

#### For Deep Drawing Jobs

blankholder is locked to face of main slide. Main ram and die cushion operate. Die cushion used as lift-out with delayed action on return stroke.

#### For Deep Drawing Jobs

main ram, blankholder and die cushion operating. The latter serves as lift-out with delayed action on return stroke.



All pressure controls conveniently close to operator's work station.

#### And, With H-P-M

pressure resistance of each blankholder ram can be individually adjusted—invaluable when drawing parts of irregular contours where blank must be held more firmly at certain points than others.

For complete information, write for Bulletin 5600.

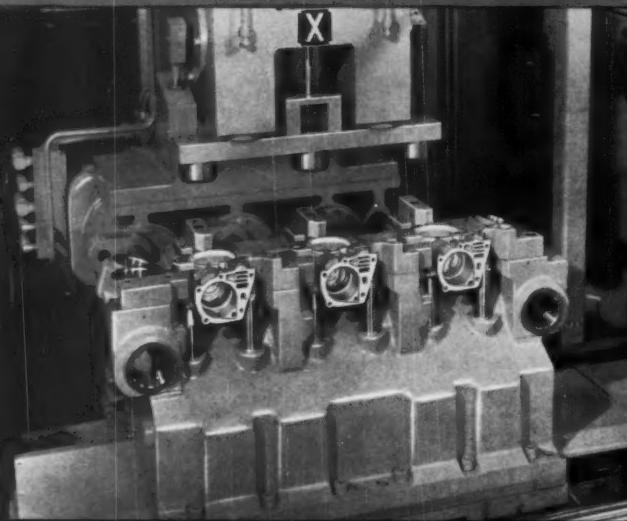
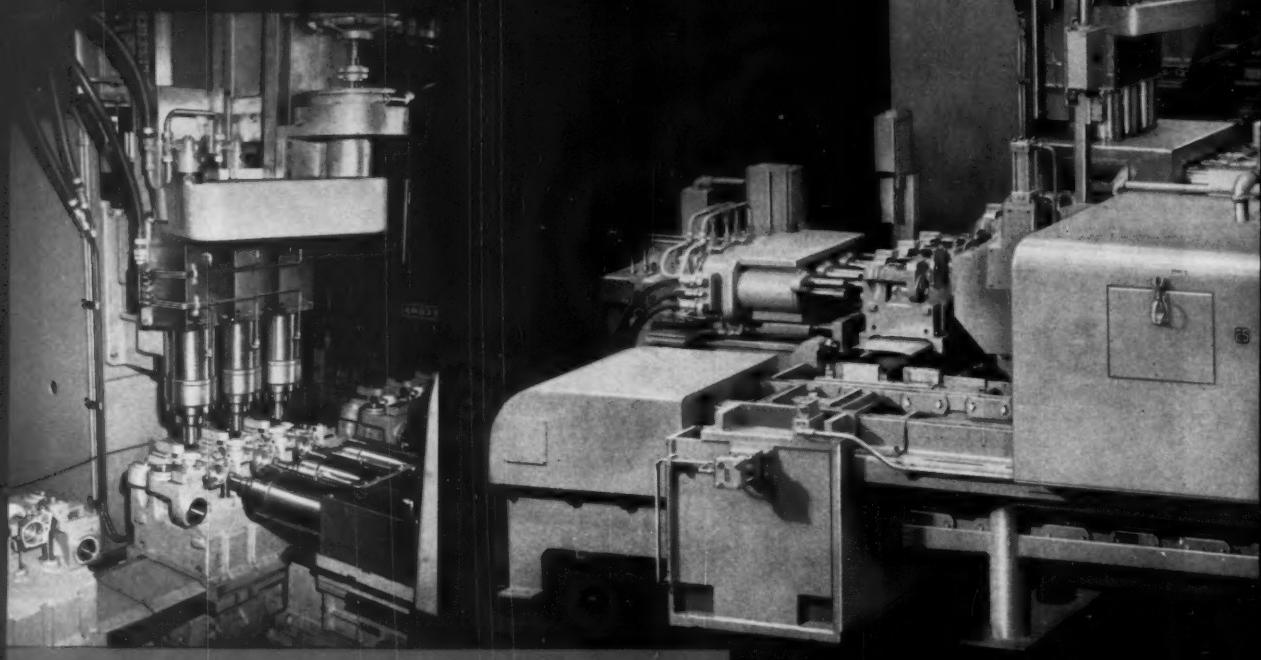
**THE HYDRAULIC  
PRESS MFG. CO.**

Mount Gilead, Ohio, U.S.A.  
A DIVISION OF KOEHRING COMPANY



# Completely Machines Servo Valve Bodies for Automatic Transmissions

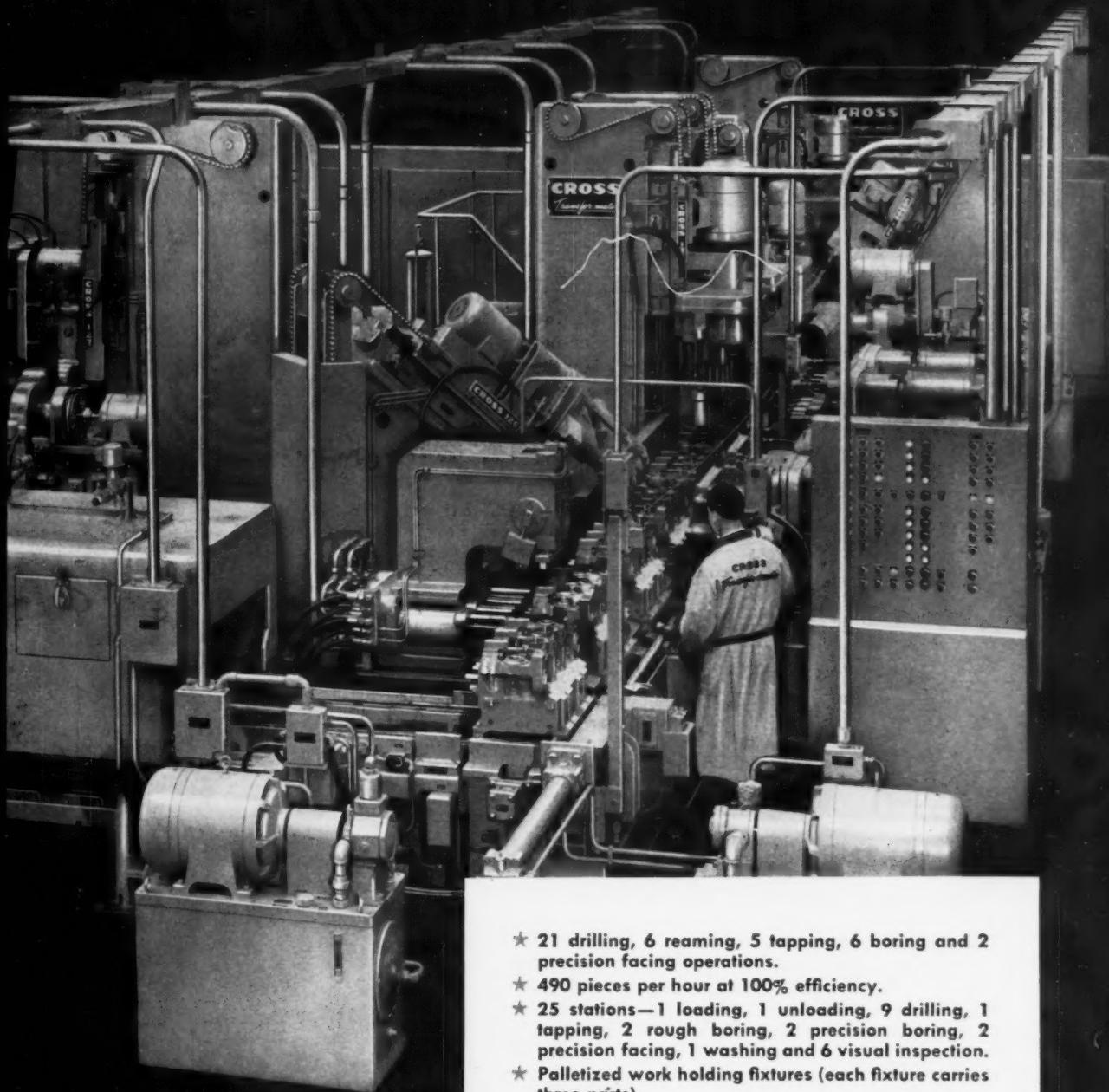
The final precision boring station.



The loading station. Part locations are checked automatically by Unit X to assure proper clamping.



*Another Transfer-matic by Cross*



Established 1898

THE **CROSS** CO.  
*First in Automation*  
DETROIT 7, MICHIGAN

- ★ 21 drilling, 6 reaming, 5 tapping, 6 boring and 2 precision facing operations.
- ★ 490 pieces per hour at 100% efficiency.
- ★ 25 stations—1 loading, 1 unloading, 9 drilling, 1 tapping, 2 rough boring, 2 precision boring, 2 precision facing, 1 washing and 6 visual inspection.
- ★ Palletized work holding fixtures (each fixture carries three parts).
- ★ Unloading unit for removing parts from fixtures and placing them on conveyor.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ "Building Block" construction to provide flexibility for design changes.
- ★ Other features: automatic washing unit for fixtures; construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping.

**There's  
MORE**

from Allis-Chalmers MOTOR distributors

# Complete Motor Line

## ... plus quality and service

As part of a national network of more than 200 franchised outlets, your nearby Allis-Chalmers Motor Distributor offers the rare combination of *fast service* and a *complete line of fine-performance integral horsepower motors*. He's the right man to give you just the right motor — in a hurry.

### It adds up to:

- 1. Simplified Buying** — Here's one source for all motors from 1 to 200 hp, as close as your telephone. Single source trims clerical costs, minimizes purchasing and accounting expenditures.
- 2. Reduced Inventory** — You don't have to tie up funds and warehouse space with spare motors and replacement parts. The A-C Distributor is your motor storehouse.
- 3. Continuous Production** — Your A-C Distributor can deliver a motor to your shop in a matter of hours. (And, once you order an A-C motor, you're sure of 'round-the-calendar operation.)

GET ACQUAINTED with your Allis-Chalmers Motor Distributor soon. You can find out his name by contacting the A-C sales office in your area, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

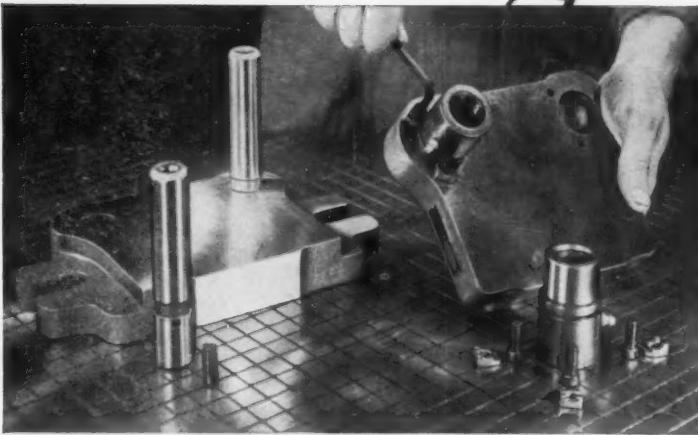


Synduction is an Allis-Chalmers trademark.

# ALLIS-CHALMERS



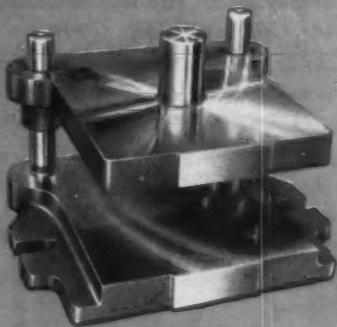
# **NEW** quick change demountable bushings



## ON **NEW DANLY DIE SETS**

Danly's demountable bushings, a new optional feature, are easily and quickly removed or installed . . . and an ideal companion for Danly's removable guide posts. Check these advantages: first, die maintenance work or grinding is hours faster when posts and bushings can be removed; second, several sets of interchangeable guide posts and bushings can be stocked for any die set to make die set inventory more flexible; third, because no pressing of posts or bushings is involved in assembly, the highest degree of precision is assured. A leading aircraft manufacturer reports that Danly Die Sets equipped with demountable bushings and removable guide posts permitted interchange of guide posts while holding closure accuracy within .0005".

These new demountable bushings provide exceptional resistance to wear, too, especially when used in combination with Danly MICROME chrome plated precision guide posts. No matter what your specific requirements are, you'll find that Danly Die Sets work best for you.



Complete New  
"Leadership Line" Catalog  
More than 200 pages provide you  
with complete design information,  
easier selection of die sets and sup-  
plies. Write for your copy today!



**DANLY MACHINE SPECIALTIES, INC.**  
2100 South Laramie Avenue  
Chicago 50, Illinois

# "Production up more than 30% since using Texaco's tri-purpose oil"

... Pacific Fittings Division,  
General Metals Corporation,  
Hollydale, California

**This plant**, the largest pipe fitting manufacturer on the Pacific Coast, enjoys outstanding results with *Texaco Cleartex Oil*. Reports Superintendent Frank Morino:

"Since the introduction of *Texaco Cleartex Oil DD* as the hydraulic, lubricating and cutting oil in our automatic chuckers, we have increased production more than 30%.

"With no separate hydraulic oil to dilute the cutting coolant, we're getting longer tool life. Gear boxes and lubricating oil lines stay much cleaner. The consistent uniformity of *Texaco Cleartex Oil DD* gives us better finish on machined parts, even under stepped-up production schedules. And the transparency of the oil makes work inspection a lot easier."

There is a complete line of *Texaco Cutting, Grinding, Soluble and Hydraulic Oils* to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you make the proper selection. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N.Y.

*Pacific Fittings Division* produces a full line of pipe fittings, nipples and couplings. The New Britain Gridley automatics shown here use tri-purpose *Texaco Cleartex Oil DD* exclusively. For the past 10 years, this plant has relied on Texaco Products and Texaco Lubrication Engineering Service to keep operating efficiency high, maintenance costs low.



# TEXACO

CUTTING, GRINDING,  
SOLUBLE AND  
HYDRAULIC OILS

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

- Defense, \$1000 per Second
- Battle Stations for Industry
- Machine Tool Replacement Studied
- Washington Briefs



## Keeping up with Washington

By Loring F. Overman

**W**ASHINGTON'S military budget alone costs more than \$1000 per second—a little less than \$100,000,000 per day. The military budget for fiscal 1957 will be up a billion dollars or so. By 1958, a military budget of 40 billion dollars can be expected.

These figures give a rough idea of just how big a customer the cold war is, particularly for the things which only machines can make. The speed of hostile events in Hungary and Egypt focussed attention on the need for constant preparedness. And for what? Short war? Long war? Attack? Defense? Realization that the guns can start booming overnight has resulted in a reappraisal of defense programs.

As explained at a recent industrial defense conference in Washington: "Democracies don't plan wars any more than fire departments plan fires. Just as a fire department prepares to meet fires that might break out, we plan to meet the kinds of war which might erupt. Just as the fire department hopes never to have a fire, we, just as fervently, hope there will never be a war. We are faced with the possibilities of the long war, short war, quick war, and slow war. How do you prepare to fight long, short, quick, and slow wars?"

### Battle Stations for Industry

The program for doing this, according to J. Lewis Powell, Office of the Secretary of Defense (Supply and Logistics), is the Revised Production Allocation Program. It is the official program of the three services of the Department of Defense—Army, Navy, and Air Force. On shipboard at all times each sailor is assigned a battle station and knows what he is expected to do in an emergency. The Production Allocation Program gives battle stations to industry.

Vital to the program, according to Mr. Powell, are two things—one called an ASPPO; the other called a Register. ASPPO means "Armed Services Procurement Planning Officer." The Register lists 21,000 plants participating in the program. Some 17,000 names have been removed from the Register as being unwilling to or incapable of taking part. A listing in the Register now has meaning. Although a classified document, each manufacturer is entitled to see his own entry or to be told that he is not registered. The information can be secured from the nearest Army, Navy, or Air Force procurement officer.

### Machine Tool Replacement Studied

The Machinery and Allied Products Institute reports that the Army, Navy, and Air Force are making progress on another approach to the problem of machine tools. Upon discontinuance of the machine tool mobilization base program (\$100,000,000 a year to stockpile machine tools), each department was ordered to provide an inven-

tory of machines in use, and to recommend a replacement schedule. MAPI estimates that annual acquisitions will approximate 2 to 5 per cent of the inventory.

### Industrial Defense Charted

Executives of trade associations representing essential defense industries, when called to Washington recently, were urged to stress the importance of planning an industrial defense against nuclear attack. In discussing industrial defense, "We are prone to list only physical plant, production, and research facilities," observed William E. Haines, Director of Industrial Defense, Business and Defense Services Administration, U. S. Department of Commerce. "That is understandable," he continued, "but whatever may happen to the Nation's physical facilities, there must be preserved a legacy of managerial and technical know-how." Mr. Haines suggested that each company prepare an over-all plan for industrial defense, covering activities and responsibilities of every department from plant level to top management.

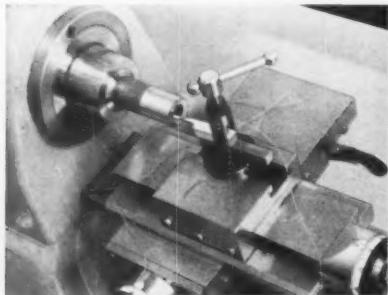
### Washington Briefs

- The Construction Machinery Industry Advisory Committee has been advised by the Government to expect in 1957 a requirement for \$1,200,000,000 worth of road-building equipment and \$400,000,000 worth of spare parts; 14 per cent above 1956 operations. Shortage of steel plate and structural forms was also forecast. The Defense Department urged industry to launch a standardization program.
- Rapid tax amortization amounting to \$36,806,926,000 has been granted to 21,587 new or expanded facilities.
- The Small Business Administration has approved 9,218 business and disaster loans totaling \$258,567,000 since October 1, 1953. October of this year brought in a record number of applications, 692. SBA approved 323 loans totaling \$13,609,000 during the month.
- Dr. Lawrence M. Kushner heads a newly organized Metal Physics Section, Metallurgy Division, National Bureau of Standards. The purpose of this section is to explore new alloys and observe their reactions under heat, stress, and fabricating processes.
- Guided missiles now represent 8 per cent of Air Force dollar procurements, with 35 per cent as the probable figure within three or four years. Five years ago, the total was 1/10 per cent. The change is expected to cause a virtual revolution within the Air Force.
- Each month the use of atoms for peaceful purposes becomes more commonplace. Newest Government move to spur use of atomic energy abroad is a cut in the price of uranium and plutonium. Another example is the signing of a fixed-price contract for construction of an atomic power plant for the first atom-powered merchant ship.

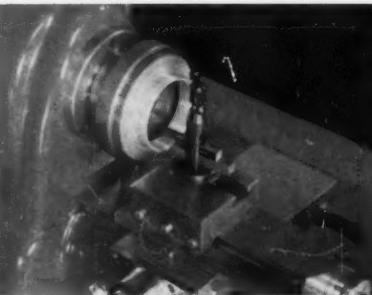
**HARDINGE**  
ELMIRA, N.Y.

## HIGH SPEED PRECISION LATHE

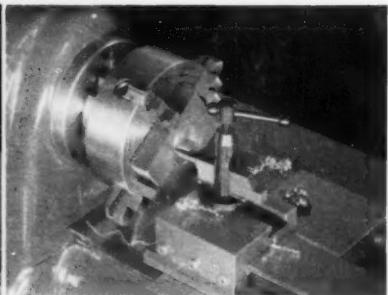
Correct Size - High Speed - Precision Results



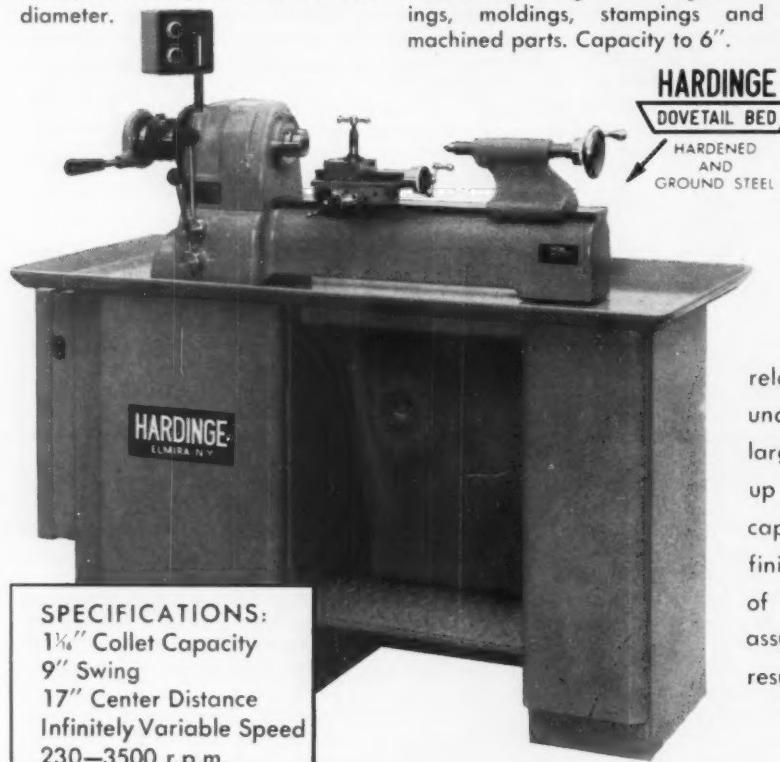
Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".



Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".



**SPECIFICATIONS:**  
1½" Collet Capacity  
9" Swing  
17" Center Distance  
Infinitely Variable Speed  
230—3500 r.p.m.

OFFICES IN PRINCIPAL CITIES.  
Export Office: 269 Lafayette St.,  
New York 12, N. Y.

Send for Free illustrated Bulletin DV 59



**HARDINGE BROTHERS, INC., ELMIRA, N. Y.**  
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

## The Year Ahead

THE prognosticator treads on precarious ground—a wrong guess, and his reputation is sullied. Probably the most noted prognosticators of all history are the Old Testament prophets. Strange that they should have been honored as they were, for they invariably prophesied doom.

How different this day and age! Prognosticators of flourishing business in recent years developed reputations for being most astute, because our National prosperity has, generally speaking, exceeded their most optimistic predictions. The picture for 1957 looks even better than the prosperous recent past.

For example, whereas the gross national product now stands around the 400-billion-dollar mark—the highest plateau ever reached—it is expected to get up to 425 billion dollars by the middle of the year. Latest figures show 66,000,000 people employed; the greatest number in our history.

Over the long future, all signs point to an even higher level of prosperity than we now enjoy. The mammoth highway-building program will be a boom to many industries and particularly to the metalworking industries. Tremendous demands will be placed directly

on the manufacturers of road-construction machinery and allied equipment, and indirectly on the builders of machine tools and the makers of cutting tools and dies, welding and allied equipment. About 2 billion dollars will be spent in 1957 alone for road-building equipment and over \$400,000,000 for spare parts. A large percentage of this money must be spent in buying the equipment necessary for making the road-building machinery.

Automobile manufacturers view 1957 as the second biggest year in the history of their industry. Aircraft building is at an all-time high. Railroads have ordered large numbers of diesel engines and freight cars for delivery this year. Latest Department of Commerce figures place backlogs of all manufacturing industries at 62.3 billion dollars—also an all-time high.

On top of all this is the enthusiasm engendered among businessmen by the overwhelming indorsement of the Eisenhower Administration in the November elections. Business would undoubtedly have been good even if the votes had gone the other way, but it is gratifying to have a man in the White House who does not make derogatory implications about the role of business in the National economy.



EDITOR



If you machine parts like these...  
**we can save you  
 UP TO 30%**  
 ...with Ryerson leaded steels

If you machine carbon or alloy steels for production or maintenance applications—you should be able to make substantial savings by switching from a standard steel to a Ryerson *leaded* steel.

We can tell you about customers who produce up to 50% more parts per machine hour, now that they have changed over to a leaded steel recommended by Ryerson. Others report tool life lengthened as much as 300%... rejects reduced to all-time lows... machine down-time slashed... finishing processes eliminated.

The nation's largest stocks of leaded steels in a wide range of types and sizes are ready for quick shipment from Ryerson. (See listing below.) Each is the fastest machining steel of its type available anywhere. If you are not now using leaded steels, it will be worth your while to investigate the possibility of adapting one of them, or several, to your operations.

A Ryerson representative will be glad to work with you. Show you dozens of case histories—good hard facts that document just how well Ryerson leaded steels have worked out under actual shop operating conditions. Call your nearby Ryerson plant.

**LEADED STEELS IN STOCK**

**CARBON STEEL BARS**

Ledley (Screw Steel)... Cold drawn rounds, squares, hexagons.

Rycase (Case Hardening, Low Carbon, Manganese)... Cold finished rounds.

**ALLOY STEEL BARS**

Rycut 20 (Low Carbon, Case Hardening)... Hot rolled and cold finished rounds.

Rycut 40 (Medium Carbon)... Hot rolled and cold finished rounds, annealed to heat treated and stress relieved.

Rycut 47 (Medium Carbon)... Hot rolled, unannealed rounds.

New Rycut 50 (Medium Carbon)... Hot rolled and cold finished rounds in annealed condition, hot rolled rounds heat treated and stress relieved.

Leaded 8620... Rounds hot rolled, cold finished.

Leaded 4140... Rounds, cold finished, unannealed or heat treated and stress relieved.

Leaded 8647... Rounds, hot rolled, unannealed.

**CARBON STEEL PLATES**

New E-Z-Cut Plates (Hot rolled, low carbon, manganese.)

# RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI  
 CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE



By JOHN HEDGES  
Supervisor of Tools  
Cummins Engine Co., Inc.  
Columbus, Ind.

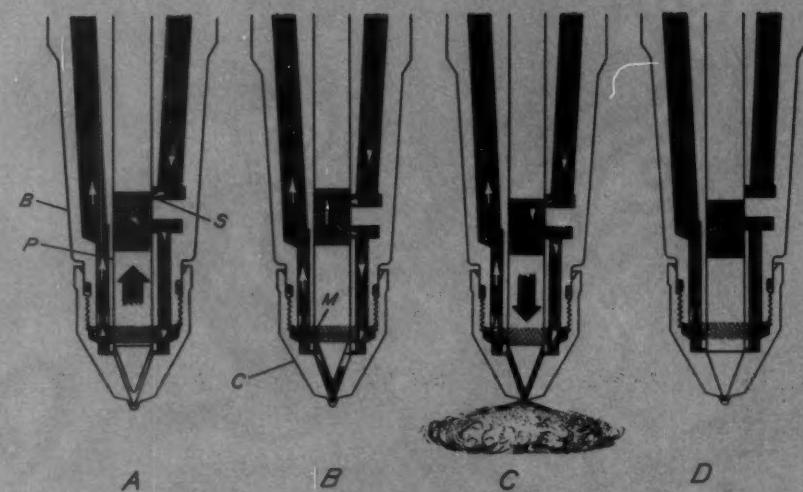
# FUEL INJECTORS CALL FOR MICROSCOPIC METHODS

Diesel engines now power over 60 per cent of all heavy-duty trucks. Efficient, lightweight versions of the engine are rapidly increasing its popularity in medium-duty trucks. Key to the success of the diesel is its fuel injector.

A SIMPLE fuel injector comprising only seven parts holds the key to the new PT fuel system in diesel engines manufactured by the Cummins Engine Co., Inc., Columbus, Ind. This company builds diesel engines in the 75- to 600-H.P. range. The injector is a mechanical device actuated through linkage with the engine camshaft. Its operating principle is explained in the four views in Fig. 1.

At the start of the up stroke, view A, as plunger *P* rises in body *B*, supply hole *S* is uncovered, and fuel circulates through the injector

**Fig. 1.** These four views illustrate the fuel injection cycle of the PT system in the diesel engine.



and out of the drain at the left. Approximately four-fifths of the fuel delivered to the injector is returned to the fuel tank. When the plunger has uncovered metering orifice *M*, view *B*, fuel enters injector cup *C*. The length of time this opening is uncovered and the pressure supplied by the fuel pump of the engine determine the quantity of fuel injected.

As the plunger moves down, view *C*, it forces fuel through holes in the tip of the injector cup and into the cylinders in the form of a fine spray which mixes with the air compressed in the cylinder. Following injection, the plunger remains seated (as in view *D*) until it is time for the cycle to be repeated.

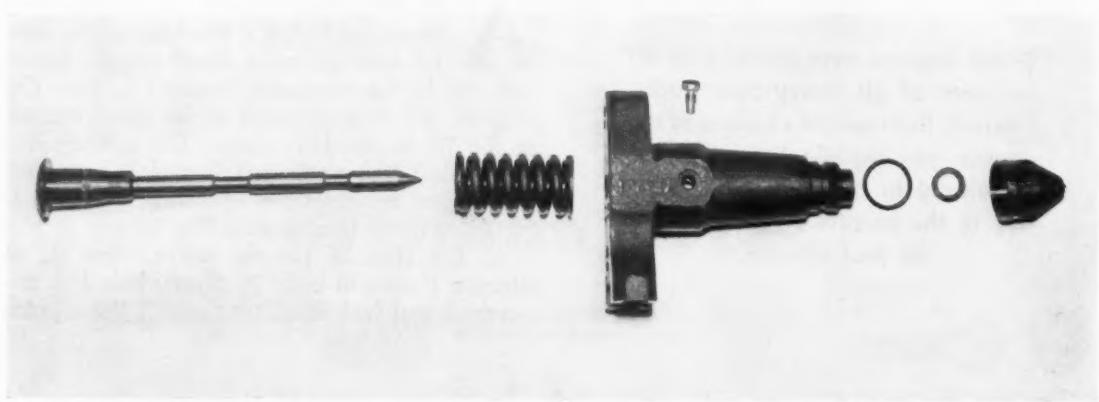
For the cup, plunger, and body, illustrated in Fig. 2, tolerances are extremely close. Production requirements are high (there being one injector needed for each engine cylinder), and dimensions such as the spray-hole diameters in the

cup are virtually infinitesimal. Highlights in the processing of these items show how the skills to do the job have been embodied in standard and special equipment.

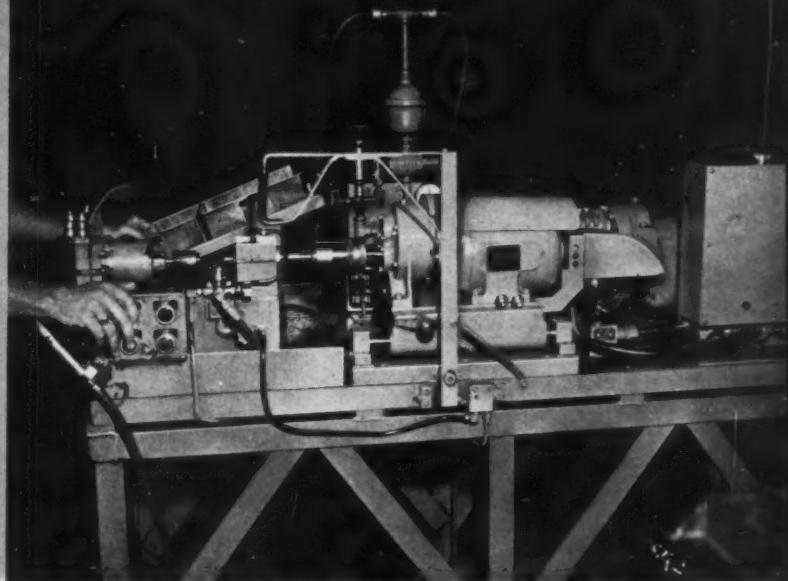
In Fig. 3, for example, is one of the machines which reams the bore of the cup. This is a 60-degree tapered hole which receives the cone of the plunger. Extreme accuracy must be maintained. Since the depth of cut determines the size of the taper, the feed for the reamer must terminate at a precise point.

This is done by means of a cam feed of the spindle quill. The cam, driven by a separate reduction-gear motor, is isolated from the spindle drive motor, and thus is protected against heat and subsequent expansion. Cups are held in an air-operated collet, seen in front of the operator, which is advanced automatically to the work-fixture. During the cycle, the reamer revolves relatively slowly and enters the opposite

**Fig. 2.** Exploded view of fuel injector. Plunger, body, and cup are main parts and demand precision machining.

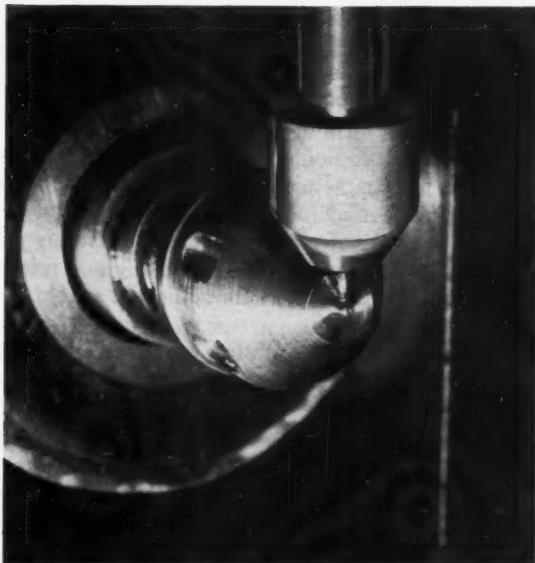


**Fig. 3. (Right)** The special design of this machine accurately controls the feed limit of a tapered reamer.



**Fig. 4. (Below)** A greatly magnified view of the cup and the 0.006-inch drill.

**Fig. 5. (Below, right)** Four bodies are gun-drilled at the same time. The trepanning action of the cutters assures straight holes. Inset shows tool tip detail.



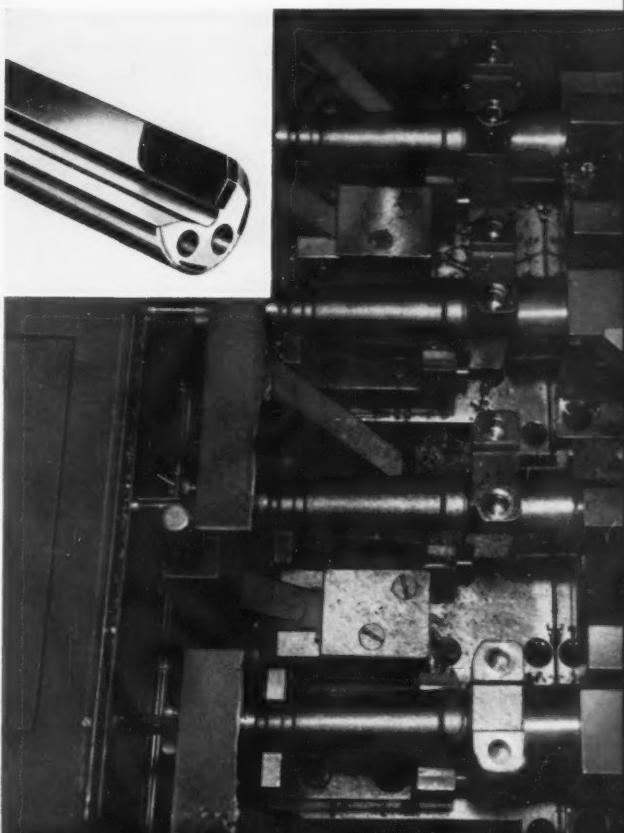
side of the fixture. Between cycles, the operator can manipulate a lever (seen attached to the front edge of the table) to blow out the fixture and advance the reamer for inspection.

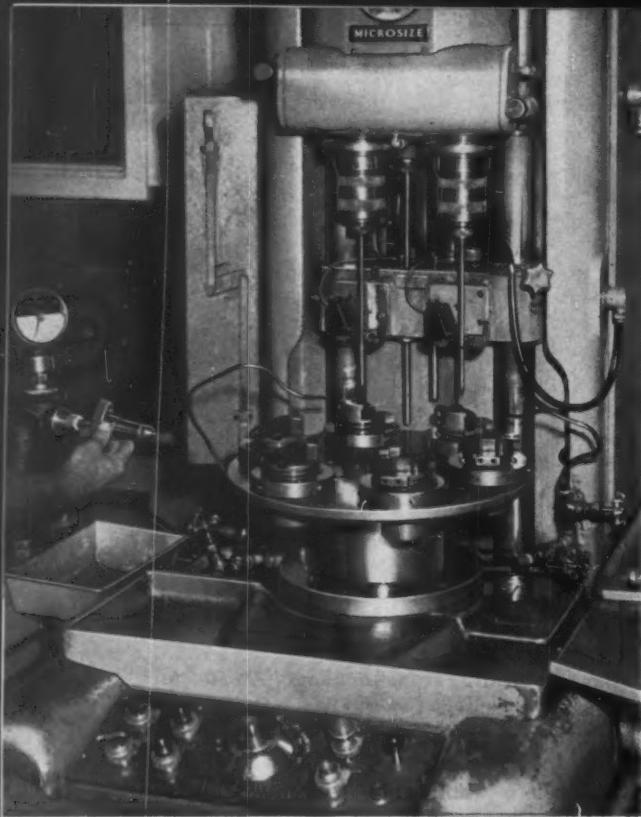
The tiny holes around the tip of the cups, through which the diesel oil is sprayed into the engine cylinders, are produced on a sensitive drilling machine such as the one appearing in the heading illustration. These holes vary in number and size, according to the engine model. In this particular instance, seven 0.006-inch diameter holes are being drilled. A magnified close-up view of the cup and drill spindle is shown in Fig. 4.

The drill spindle runs in sapphire bearings at 3200 R.P.M. Vibration is eliminated by mounting the motor on a separate pedestal, thus protecting

the fragile drill from breakage. An indexing fixture (concealed by the operator's left hand) supports the cup. The feed-rod is delicately balanced. A microscope for observing the drilling action is a permanent part of the setup.

Following tracer-lathe turning and facing, the fuel-injector bodies undergo the gun-drilling operation illustrated in Fig. 5. This is a close-up view of an Ex-Cell-O Bor-Dril. Four bodies are handled simultaneously. (In the illustration, the roll clamps securing the work are shown in raised position.)





**Fig. 6. Honing on this machine sizes the body bores automatically. The air gage seen at the left grades the work for selective assembly**

The hole is  $3/8$  inch in diameter and  $5\frac{1}{4}$  inches long. Drills rotate at 2000 R.P.M. and feed at 2 inches per minute, so that a complete cycle takes only three minutes and twenty seconds. To obtain a perfectly straight hole, the drill trepans a slender cylindrical slug which serves as a pilot. The slug remains fixed until the hole is completed.

The inset in the illustration is a view of the tool (called a "Target" by the manufacturer, National Twist Drill & Tool Co.). Coolant under high pressure reaches the carbide tip through two holes running the length of the drill, washing the chips back into the body clearance. Along the axis is a milled concave section which permits forming the slug. As a check for hole straightness, the two ends of the slug can be readily "miked."

Honing operations follow gun-drilling, to bring the body bore to final size. The hole requires an extremely close tolerance—plus or minus 0.0003 inch—and undergoes selective assembly to the plunger. Such a close fit is needed to contain the high air temperature created by the 16 to 1 compression ratio of the diesel engine.

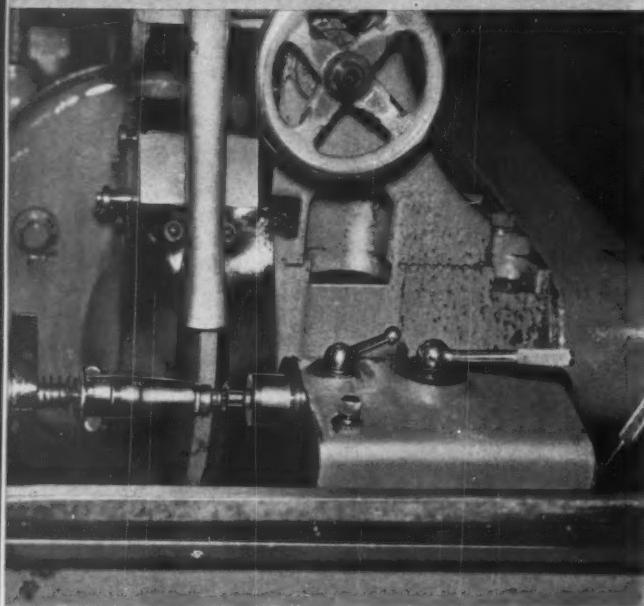
One of the honing operations is shown in Fig. 6. Two parts are being processed simultaneously on the machine, a Micromatic Hydrohoner. A six-station dial table provides continuous production, by permitting the unloading and reloading of inoperative stations while the machine is running.

Above each work station is a Norbide sizing ring through which the honing tool reciprocates. When size has been reached at either station, the ring automatically prevents further expansion of the stones in the tool; and when both holes reach size, the machine automatically shuts down. Grading is done on the air gage seen at the left of the machine. There are four classifications, each having a range of plus or minus 0.0005 inch.

Cup and body are threaded for fastening together. The cup thread is planetary-milled, and the body thread is ground. One of the two Sheffield machines which grind the body thread is shown in Fig. 7. The grinding wheel form, maintained by crush-truing, produces a Class IV 1/20-pitch thread.

An unusual arbor design is used to support the work between centers. The arbor has no contact with the bore, being somewhat under size. Each end of the arbor is tubular with three free-floating small balls which are spaced radially in the wall. When the arbor is positioned between the machine centers, the balls are thrust out equally to centralize and grip the work.

After loading, the cycle is automatic, and one operator tends both machines. A temporary cap



*Fig. 8. The hydraulic cylinder thrusts work-piece into the machine for the plunge-grinding of the point and the recesses.*



is screwed onto the thread as a protection during later processing.

Plungers for the fuel injector are turned and cut off on an automatic bar machine, then centerless ground and lapped to a finish of 1 to 3 micro-inches. The conical point and the recessed areas of the periphery are plunge-ground on the Cincinnati centerless machine shown in Fig. 8. Material handling is completely automated.

Work-pieces roll down a chute, and the hydraulic cylinder seen in the foreground advances

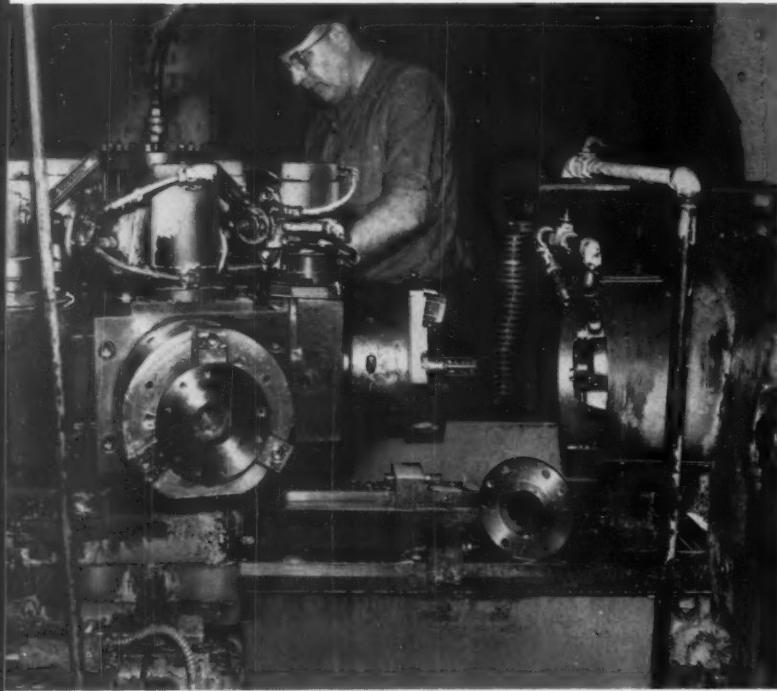
each piece into the machine. The regulating wheel then forces the plunger back against a carbide bar stop, and grinding proceeds until the recesses and point are produced.

Each completed injector assembly is subjected to the spray test illustrated in Fig. 9. The assembly is cradled in a fixture and placed under oil pressure. By the nature of the spray emerging from the cup, the inspector can detect such defects as plugged holes, incorrect spray angle, burrs, cracks, dirt, or sticky plungers.

*Fig. 9. A spray test facilitates detection of plugged holes, sticky plungers, or other defects in the completed assembly.*



# Unusual Setups on



By D. L. HANSEN  
Mechanical Engineer  
Tractor Works  
International Harvester Co.  
Chicago, Ill.

**U**NUSUAL setups on Potter & Johnston automatic turret lathes are employed by the Tractor Works of the International Harvester Co., Chicago, Ill., to machine certain tractor parts required in large volume. In one such setup, work-pieces are held in five air-operated chucks mounted on the turret, while tools in a holder mounted on and rotated by the spindle do the required cutting. With this arrangement, seen in the heading illustration, it is possible to unload and reload the chucks in the idle position while the chuck that is mounted at the turret station in front of the machine spindle is operative.

In this instance, the work-piece is a flange with a short hub. It is used as a track roller-bearing retainer. Two tools mounted in a spindle-holder cut grooves for seal rings near the center of the flange. Approximately one hundred parts per hour are completed.

Track roller-shaft brackets are machined on the turret lathe shown in Fig. 1. The work has a hub, by which it is held in the usual manner in a three-jaw chuck carried on the spindle. The flange is faced from the cross-slide, and a recess is bored from the turret. Next, the turret is indexed, and

the recess is reamed by a tool which is located at a subsequent station.

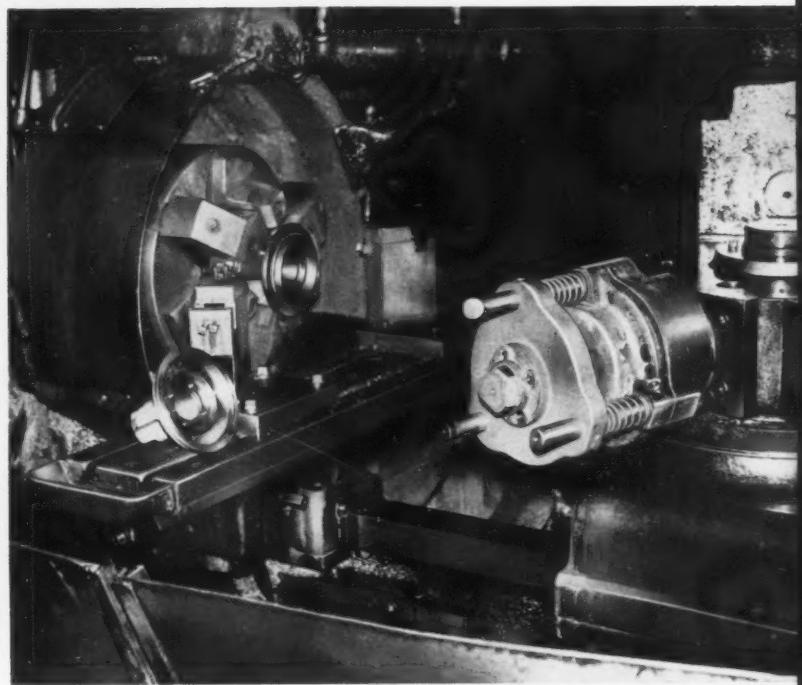
Of special interest, however, is the use of a four-spindle U. S. drill head mounted at one of the turret stations. When this station is operative, the head revolves with the machine spindle and drills four holes in the flange. In service, lugs on rotary type oil seals enter the holes and prevent the seals from turning during tractor operation.

Before the drills start cutting, the head has to be "picked up" by the spindle. This is done by having the projecting ends of the three guide-plate rods enter corresponding holes in the chuck. The head thus revolves in unison with the spindle, and gearing in the head transmits the drive to the four drills. As the turret is fed forward, the revolving drills enter the work. This setup eliminates transferring the work to a drill press, as was done formerly. Eight brackets per hour are handled.

Similar work on another track roller-shaft bracket is done on a double-spindle Potter & Johnston automatic turret lathe, Fig. 2. In this case, two chucks, both air-operated, and two five-spindle U. S. drill heads are used. As in Fig. 1, the heads are "picked up" through guide-plate

# Automatic Turret Lathes

*Fig. 1. The machine spindle drives the drill head in unison. Simultaneously, the drills in the head revolve around their axes.*

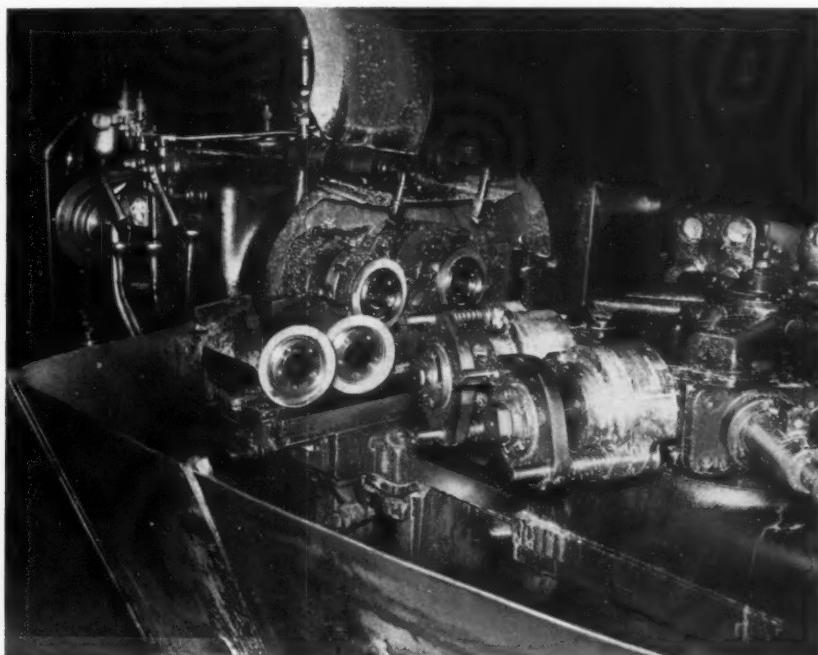


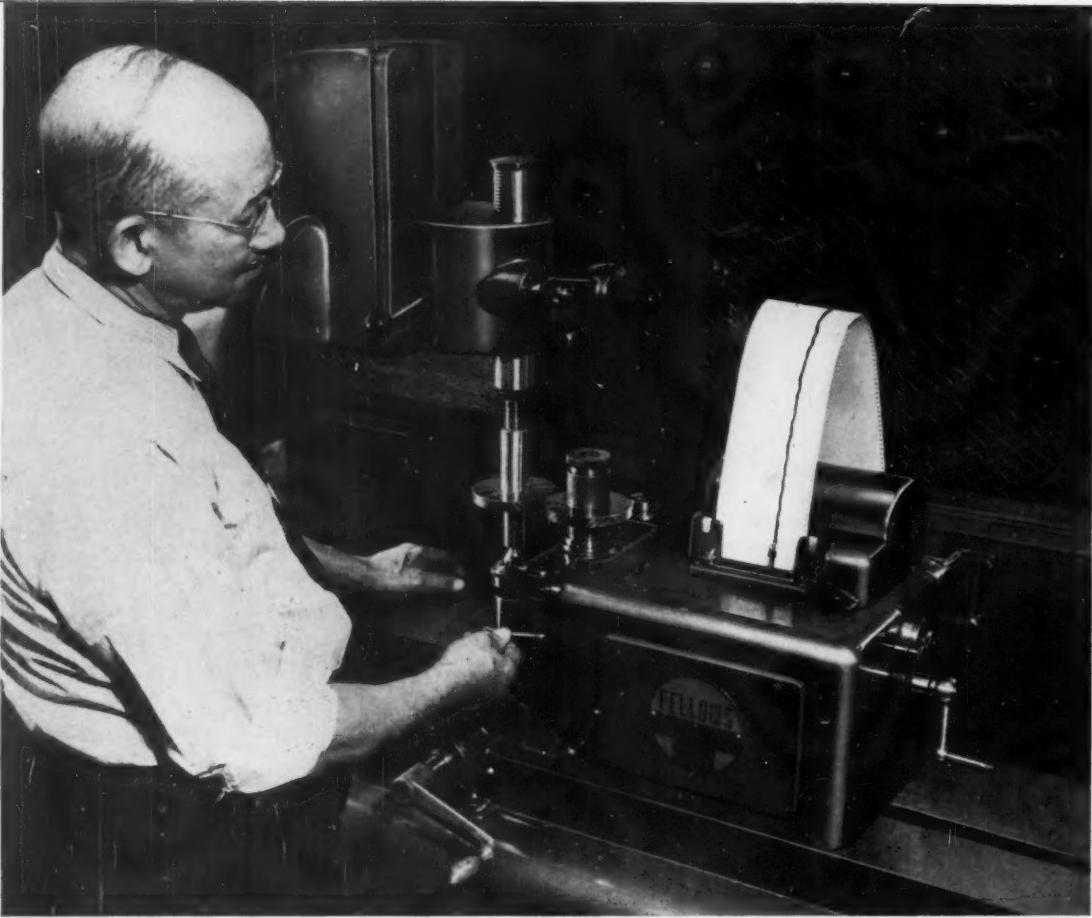
rods. However, there are only two rods per head, and one, being longer than the other and provided with a flat, must enter a corresponding hole in the chuck. This gives the hole circle a specified angular location in reference to the hub of the part. Output of this machine is sixteen brackets per hour.

## Light Weight of Turbo-Prop Engine

The Allison 501 turbo-prop engine, or the T56—as it is known in its military designation—develops 2.3 H.P. for each pound of engine weight. This is a power-to-weight ratio more than twice the standard of piston engines in current use.

*Fig. 2. One guide-plate rod of each head is able to enter only one of the holes in each chuck, thus assuring the specified angular location of hole circle.*





Courtesy, Sier-Bath Gear & Pump Co., Inc.

## "Mastering" Master Gears

Gears can be designed to a high degree of precision and all due care exercised during their production, but to evaluate the finished product an accurate inspection medium must be used. This frequently takes the form of master gears that are run together with the production gears. Master gears must be as nearly perfect as possible.

By MARTIN A. HARTMAN

IT is axiomatic that a production gear can be inspected only to the accuracy of the master gear with which it is checked. If master gears could be made perfect in every dimension, it would be entirely possible to measure all the errors in imperfect gears. But there is no such thing as a perfect master gear. However, the closest possible accuracy can be obtained by controlling the master gear blank and its fabrication.

When a production gear is checked by turning it in mesh with a highly accurate master gear in a variable-center-distance rolling fixture, any errors observed are due basically to the production

gear. This is true, of course, if slight errors of the recording mechanism and the master gear are not taken into consideration.

### **Types of Master Gears**

Consideration will be limited to spur and helical master gears—no attempt will be made to include double helical gears or other types. Although only external gears will be covered, the same information can be applied to racks and to the few, isolated cases where an internal master might be used.

**Table 1. Chemical Composition of Steels Recommended for Producing Master Gears**

|               | Composition, Per Cent |      |      |       |       |      |
|---------------|-----------------------|------|------|-------|-------|------|
|               | C                     | Mn   | Si   | Cr    | V     | Mo   |
| First choice  | 2.15                  | 0.35 | 0.35 | 12.00 | 0.50* | 0.80 |
| Second choice | 1.50                  | 0.35 | 0.35 | 12.00 | 0.50* | 0.80 |

\*Optional

Most of the spur and helical master gears made in the United States have the following specifications: a pitch diameter of up to 12 inches, a maximum diameter of 9 inches being preferred; a maximum face width of 3 inches, with 2 inches preferred; a diametral pitch ranging from 4 to 48; a maximum helix angle of 45 degrees for helical gears; and a pressure angle ranging from 14 1/2 to 30 degrees.

Helical gears are considered to have a face-contact ratio of at least 1.00 or greater. This means that the actual face width multiplied by the tangent of the helix angle must be greater than the transverse circular pitch of the gears. If face advance is not greater than the circular pitch, the gears will be considered as spur gears because it is felt that overlapping face contact is necessary to obtain benefits from a helical gear.

Three types of master gears are in common usage—they are termed final inspection, green, and sample master gears. Final inspection master gears are generally made to closer tolerances than the production gears that will be checked against them. Although they are highly accurate in dimension and shape, complete information should be available on any slight errors that are invariably present in all master gears.

Green master gears are used to check unfinished gears. The master is made off-standard to allow for production gear differences in the vari-

ous components, for changes caused by heat-treatment, or for excess material to be removed by subsequent grinding.

Sample master gears are simply production gears that are retained for control of quality or for reference purposes. Generally, the heat-treatment, hardness, and other specifications are the same as for the production gears. Sample master gears are employed most often with worm and bevel gears, but can also be used for spur and helical gears.

### Master Gear Materials

Forgings, bars, plates, or round stock may be used as the basic shapes from which master gears are produced. forgings are preferred, but the additional expense and time delay involved in obtaining them do not generally warrant the increase in quality. Round stock is next in preference for round gears, while bar stock is best for rack gears.

Two types of steel are acceptable for master gears. These steels must be able mainly to resist wear and also resist size growth. They must also be non-deforming, easily hardened, and readily available. The preferred steel is a high-carbon, high-chromium, air-hardening tool steel. The approximate chemical compositions of these steels are shown in Table 1.

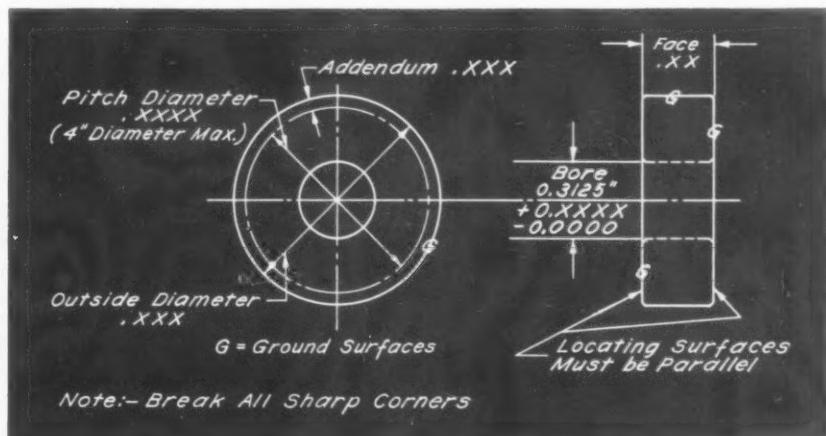
### Heat-Treatment of Preferred Steel

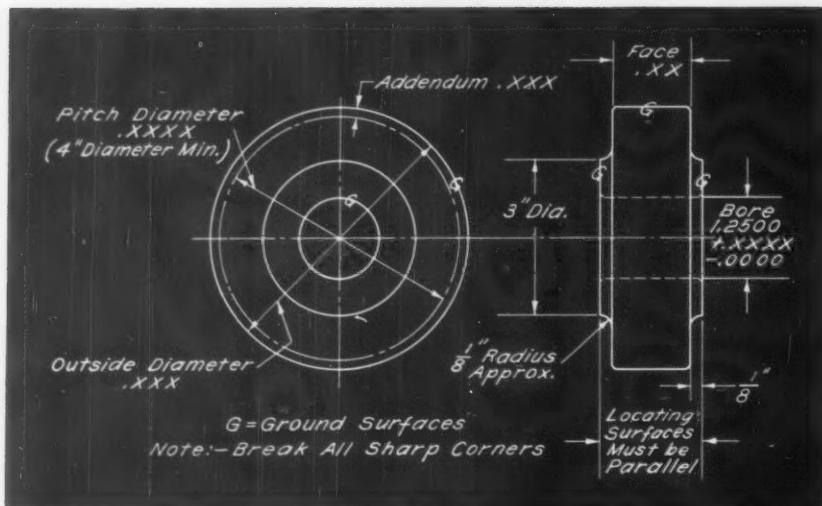
The heat-treatment procedure for gear blanks of air-hardening tool steel is as follows:

1. Preheat blank to a temperature ranging from 1200 to 1500 degrees F. for a minimum time of one-half hour.

2. Soak for sixty to ninety minutes in a controlled atmosphere at a temperature ranging from 1850 to 1875 degrees F.

**Fig. 1. The sides of Type 1 master gear blanks are flat and parallel. This type blank is used for master gears having a diametral pitch of 20 and finer and a maximum pitch diameter of 4 inches.**





**Fig. 2. Master gears that are coarser than 20 diametral pitch and that have a pitch diameter in excess of 4 inches should be cut on Type 2 gear blanks.**

3. Harden by quenching in air at room temperature.
4. Temper at 275 to 300 degrees F. for two hours.
5. Freeze at minus 100 degrees F. for two hours.
6. Rough-grind if necessary.
7. Temper at 275 to 300 degrees F. for two hours.
8. Freeze at minus 100 degrees F. for two hours.
9. Temper at 275 to 300 degrees F. for two hours.
10. Quench gear in air.
11. Finish-grind.
12. Test gear hardness (63 Rockwell C, minimum).
13. Temper at 275 to 300 degrees F. for two hours (cool in air).

The reason for alternate tempering and freezing of the gear blank is to insure that dimensional change has ceased and that most of the residual stresses have been removed. It has been found that three temperings will eliminate most subsequent growth of the steel blank.

#### Gear Blank Considerations

Standard master gear blanks can be made in two types. The controlling factors of each category are maximum and minimum number of teeth, pressure angle, pitches, and pitch diameter.

Type 1 gear blanks are of 20 diametral pitch or finer and have a maximum pitch diameter of 4 inches. It can be noted in Fig. 1 that the entire sides—or locating surfaces—are flat and parallel, and that the mounting bore is 0.3125 inch in diameter. If a rack type gear is used, the length of the rack determines the number of teeth,

while the mounting method controls hole size and location.

Type 2 gear blanks are coarser than 20 pitch and have a minimum pitch diameter of 4 inches, as shown in Fig. 2. The locating surfaces, or sides, have 1/8-inch bosses that are ground flat and parallel. The mounting bore is 1.2500 inches in diameter. As was the case with racks falling within the Type 1 classification, the rack length and the mounting method will control the number of teeth and the hole size and location, respectively.

Master gears in the Type 2 group may have a pitch diameter ranging from 4 to 9 inches. It is generally desirable, however, to standardize the size of master gears. Therefore, pitch diameters of 1, 2, 3, 4, 5, 6, and 7 inches will cover most of the sizes normally used in both categories. Rack lengths may be approximately three times their pitch diameter.

The face width of a master gear should be equal to, or larger than, the face of the production gear being checked. A rule-of-thumb for the face width of a universally used master gear is to make it equal to approximately five times its circular pitch. For example, a gear with a diametral pitch of 16 has a circular pitch of 0.1964 inch. Five times 0.1964 inch equals 0.982 inch, or approximately 1 inch of face width.

When a production gear has a shortened addendum the master gear should be made with a longer addendum; the increase in the addendum and the circular tooth thickness of the master gear being equal to the reduction in the addendum and the circular tooth thickness of the production gear being checked. Similarly, when the production gear being checked has a longer addendum the master gear addendum should be shortened an equal amount. However, if the

effect of the longer addendum is slight, or if the quantity of production gears is small, a standard master gear may be used.

Many manufacturers of master gears vary the addendum of their gears to allow for large differences in circular tooth thickness—especially in rack type masters. This is done to insure that the proper depth of contact is maintained with the face of the production gear being checked.

Before teeth are rough-cut in a master gear blank, it must be inspected to ascertain that it is within the desired tolerances with regard to

size, parallelism of faces, and runout. A finished master gear can only be as accurate as the blank from which it was cut.

If the periphery is used for locating the blank before finish-grinding the teeth, it should be true with the bore, or reference plane, within 0.0002-inch total indicator reading (0.0001 inch for Class 4 gears). If the periphery is not used as a locating surface, the runout of the outside diameter of the gear blank with relation to the bore as shown under the tolerances found listed in Table 2 is acceptable.

**Table 2.** Suggested Tolerances for Standard Master Gears\*

| Class†  | 1                | 2                | 3                | 4                |
|---|------------------|------------------|------------------|------------------|
| Hole size   |                  |                  |                  |                  |
| Pitch diameter up to 4.0000 .....   | 0.3125 to 0.3127 | 1.2500 to 1.2502 | 0.3125 to 0.3126 | 1.2500 to 1.2501 |
| Face runout of locating surfaces with respect to bore,<br>total indicator reading per inch of diameter .....                            | 0.0001           |                  |                  |                  |
| Outside diameter size tolerance .....   | +0.0000 -0.0020  |                  | +0.0000 -0.0010  |                  |
| Runout of outside diameter with respect to bore .....   |                  | 0.0010           |                  |                  |
| Runout of gear teeth (measured by a pin or ball)  |                  |                  |                  |                  |
| Pitch diameter up to 4.0000 .....   | 0.0005           | 0.0004           | 0.0003           | 0.0002           |
| Over 4.0000 and to 8.0000 .....   | 0.0009           | 0.0007           | 0.0005           | 0.0003           |
| Over 8.0000 and to 12.0000 .....  | 0.0013           | 0.0010           | 0.0007           | 0.0004           |
| Gear tooth size measured over pins .....  |                  | +0.0100 -0.0000  |                  |                  |
| Circumferential lead per inch of face width, or parallelism<br>of spur teeth with axis .....  | 0.0002           |                  | 0.0001           |                  |
| Any face width under 1/2 inch .....   | 0.0001           |                  | 0.0001           |                  |
| Pitch Error, tooth-to-tooth variation (not over pins)   |                  |                  |                  |                  |
| Pitch diameter up to 4.0000 .....   | 0.0002           |                  | 0.0001           |                  |
| Over 4.0000 and to 8.0000 .....   | 0.0003           |                  | 0.000015         |                  |
| Over 8.0000 and to 12.0000 .....  | 0.0004           |                  | 0.0002           |                  |
| When it is necessary to control the total pitch error between any two<br>nonadjacent teeth the following tolerance data are recommended |                  |                  |                  |                  |
| Total pitch error between any two teeth   |                  |                  |                  |                  |
| Pitch diameter up to 4.0000 .....   | 0.0004           |                  | 0.0002           |                  |
| Over 4.0000 and to 8.0000 .....   | 0.0005           |                  | 0.0003           |                  |
| Over 8.0000 and to 12.0000 .....  | 0.0006           |                  | 0.0004           |                  |
|   |                  | Spur             | Helical          |                  |
| Profile error, total variation  |                  |                  |                  |                  |
| Pitch diameter up to 4.0000 .....   | 0.0002           |                  | 0.0003           |                  |
| Over 4.0000 and to 8.0000 .....   | 0.00025          |                  | 0.00035          |                  |
| Over 8.0000 and to 12.0000 .....  | 0.0003           |                  | 0.0004           |                  |

\* Modified from AGMA Standard 235.01, Gear Inspection and Tolerances—Master Gears, October, 1947. (All dimensions in inches)

Mentioned from AGMA Standard 255.01, Gear Inspection and Tolerances—Master Gears, October, 1941. (All dimensions in inches.)  
Class 1 and Class 2 are used most often to check commercial type gears, with Class 2 being used for higher pitch-line velocities. A typical application of Class 3 would be for high-speed aircraft gears. Class 4 is used mainly for precise control gears of the highest quality, such as those found in the gear data drives for radar antennas and guided missiles.

### **Forming the Gear Teeth**

Material must be allowed for a grinding operation in the forming of a gear tooth. For gears of 20 diametral pitch and finer, a stock allowance of 0.003 inch or less for each side of the tooth is sufficient. For coarser pitches, approximately 0.005 inch of stock for each side of the tooth is maximum. The finer the pitch, the less stock required.

Pregrind sizes should be given over pins and should state how much stock is allowed either on each side of the tooth or on the total circular tooth thickness. The ideal circular tooth thickness is usually equal to one-half the normal circular pitch, with a plus allowance of 0.0003 to 0.0004 inch for wear. The finish on all ground surfaces should be approximately 16, with a maximum of 32, micro-inches. A maximum roughness of 16 micro-inches should be maintained on the gear profile.

Gear teeth should be roughed out before hardening, preferably by at least a Class B hob. On gears of 20 diametral pitch or finer, the teeth may be rough-ground from a solid piece. A gear shaper also can be used to rough out the teeth but a tooth drop or a tooth rise is not permissible. The roughing operation must make the whole depth sufficient so that the grinding wheel will not bottom heavily and so that it will not be required to remove large amounts of stock from the root before contacting the sides of the teeth. If only the sides are finish-ground, the need for root clearance is of particular importance. To provide clearance at the bottom of the tooth, a protuberance type of hobbing or shaping tool is almost a necessity.

When setting up a roughed-out gear blank, the highest point on the plus side of the tolerance should be known, and grinding should start there. This will enable the machine operator to make a greater number of corrections in the grinding wheel setting. It will prevent the sudden removal of a large amount of metal and will minimize burning of the gear-tooth profile. For air-hardening steels, a soft, well-dressed wheel will give best results.

### **Inspecting Master Gears**

As much, or more, time is frequently spent inspecting a master gear than was required to manufacture it. Before final inspection all sharp edges and burrs must be removed. Burns or grinding checks should not be present. Burns can be made visible by etching with nitric acid. This causes burned areas to become gray or black. Checks generally appear as cracks or lines

**Table 3. Approximate Minimum Number of Teeth Generated Before Under-Cutting Begins\***

| Pressure Angle, Degrees | Minimum Number of Teeth Desired | Minimum Number of Teeth Before Under-Cutting Starts |
|-------------------------|---------------------------------|---|
| 14 1/2                  | 40                              | 32  |
| 20                      | 26                              | 18  |
| 22 1/2                  | 23                              | 15  |
| 25                      | 20                              | 12  |

\* Based on standard addendum of  $1/P_d$  and a whole depth of  $2.250/P_d$ .

lying at a 90-degree angle to the radial path of the grinding wheel.

Every error in a master gear should be carefully recorded. Many inspections may be made to double-check previous results. Careful inspection of the following items should be made on each master gear produced:

1. Involute or profile.
2. Out-of-roundness.
3. Tooth-to-tooth spacing.
4. Total pitch error.
5. Diameter over pins (circular tooth thickness).
6. Face helix angle or deviation of the tooth from a straight line.
7. Surface and mounting runout.
8. Actual sizes of various dimensions and other specifications of a particular gear.

Once the inspections have been completed, a permanent record should be made so that the exact values of all errors are known. This record must be kept up to date. Master gears should be inspected at least once every six months—oftener if used to any great extent.

A method of master gear inspection that is used frequently consists of placing two like master gears on a variable-center-distance checker and rolling them together. The two master gears then are disengaged, and one is rotated either 90 or 120 degrees with relation to its mating gear. They are again brought into mesh and rotated 360 degrees. This operation is repeated until the original starting point is reached. One of the master gears is then turned over and the entire procedure is repeated.

Maximum and minimum errors in the two gears can be found by this method. By proper interpretation of the results an idea of the overall accuracy of the gears can be obtained. However, care must be taken so that the proper load is placed on the teeth. Also, any sizable modifications in either master gear may appear as errors although they are necessary for the proper inspection of a production gear.

### Obtaining the Proper Center Distance

Actual circular tooth thickness of the master gear, measured at the pitch diameter, must be known when setting up the proper center distance between it and a production gear to be inspected. The center distance is the sum of the operating pitch radii of the two parts. Required information can generally be obtained by measuring over pins in at least three different points around the teeth of the master gear. These pin measurements can then be used to calculate the average value for the circular tooth thickness (see formulas in MACHINERY'S HANDBOOK or "Manual of Gear Design," by Earle Buckingham). No great deviation in size is permissible, and differences should appear in ten-thousandths of an inch. Calculations should also be made to determine the diameter at which the tooth thickness is equal to the tooth space. This information will prove to be of value in the inspection of other gears.

In modified-addendum master gears it is neces-

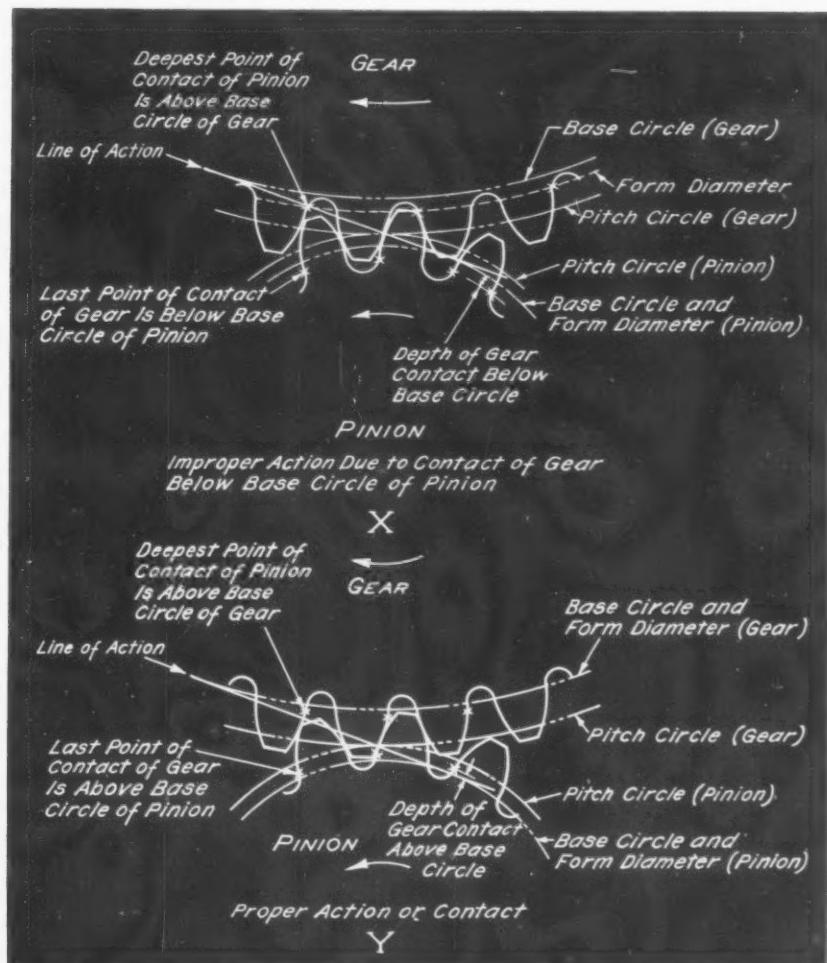
sary to calculate the diameter of contact (actual pitch diameter) at which the circular tooth thickness is equal to the exact value or size desired. Calculations are generally made to seven places.

### Special Considerations for Good Master Gears

It should be ascertained that both the master gear and the production gear to be inspected will fit in the checking fixture. On round type master gears the minimum number of teeth to be cut depends largely upon the pressure angle, the whole depth of the tooth, and the radius of the generating tool. The larger the pressure angle, the smaller the number of teeth that can be generated before under-cutting begins. In Table 3 is given the minimum number of teeth for a given pressure angle on the basis of a standard addendum of  $1/P_d$  and a whole depth of  $2.250/P_d$ .

Another problem, entirely different from that of the under-cut, is the relationship between the base-circle diameter, the diameter of the circle

**Fig. 3. Last point of contact between a gear tooth and a pinion tooth should not be below the base circle. At X is an example of improper action due to this point falling below the base circle. The gear and pinion at Y mesh satisfactorily.**



denoting the working depth of the gear, and the last point of contact between a production gear tooth and its mating tooth on the master gear. To quickly check that this point of contact is not below the base circle of a particular gear, a value equal to twice the addendum of the mating gear is subtracted from the pitch diameter of the gear

in question. The result should be larger than the base diameter.

An example of this method of checking the point of contact can be made with a hypothetical gear having a 5-inch pitch diameter, an addendum of  $1/P_d$ , a diametral pitch of 48, and a pressure angle of  $14 \frac{1}{2}$  degrees. The base-circle diameter would be 4.8407 inches and twice the addendum would be 0.0417 inch. Subtracting twice the addendum from the 5-inch pitch diameter leaves a diameter of 4.9583 inches. Since 4.9583 inches is larger than the 4.8407-inch diameter base circle the last point of contact would be above the base-circle diameter. The gear would, therefore, be satisfactory. Both incorrect and correct points of contact are shown in Fig. 3.

When a quick check shows the addendum of the mating gear to be below the base circle, another check must be used. Calculation of the last point of contact on the involute of the two gears is needed, and this point must be above the base circle for a satisfactory master gear. Generally, a minimum roll angle of 3 degrees above the base circle is desired.

A sample problem and calculation sheet for accurately determining the form diameter of a gear and pinion can be seen in Table 4. The limiting point of contact on the pinion, Item 15, is theoretically acceptable because it is above the base diameter. In actual use, however, it is very doubtful if the check could be made since the form diameter is practically at the base diameter. Because of a condition like this, it is desirable to stay approximately 3 degrees of roll angle above the base diameter.

The maximum number of teeth allowable often depends on the type of generating process employed and the checking equipment used. Gears having from 148 to 150 teeth have been ground with an accuracy equal to Class 4 on a pitch diameter under 4 inches. It should also be remembered that the greater the number of teeth on a master gear the greater the chance for increased total pitch-line error. It is advisable to keep the maximum number of teeth to approximately 50 or less, depending upon the pressure angle and other important considerations.

If there are any indications that continuous action does not exist when checking gears, and if either the test gear, master gear, or both, have a small number of teeth, the contact ratio should be checked. Normally, the contact ratio should be a minimum of 1.2, with 1.4 preferred. A contact ratio of 1.2 indicates that an average of 1.2 teeth are in contact over a given range of time. The contact ratio may be calculated by means of formulas available in either MACHINERY'S HANDBOOK or in the book "Practical Gear Design," by D. W. Dudley.

**Table 4. Calculation Sheet for Determining Exact Form Diameter**

|                |  | Pinion (p)              | Gear (g)        |
|----------------|--|-------------------------|-----------------|
| 1              | $D_o$  | 2.200                   | 3.200           |
| 2              | $D$  | 2.000                   | 3.000           |
| 3              | $P_d$  | 10                      |                 |
| 4*             | $\frac{0.100}{(3)}$                                      | 0.010                   |                 |
| 5              | $\emptyset$  | 20°                     |                 |
| 6              | $\sin \emptyset$   | 0.34202                 |                 |
| 7              | $\cos \emptyset$   | 0.93969                 |                 |
| 8              | $(2_p) + (2_g) = 2C$                                     | 5.000                   |                 |
| 9              | $(7) (2) = D_b$  | <u>1.87938</u>          | 2.81907         |
| 10             | Pinion: $(1_g)^2 - (9_g)^2$<br>Gear: $(1_p)^2 - (9_p)^2$ | 2.29284<br>....<br>.... | ....<br>1.30793 |
| 11             | $\sqrt{(10)}$  | 1.51421                 | 1.14364         |
| 12             | $(8) (6) - (11)$   | 0.19589                 | 0.56646         |
| 13             | $(12)^2 + (9)^2$   | 3.57044                 | 8.26803         |
| 14             | $\sqrt{(13)} = D_c$                                      | 1.8895                  | 2.8754          |
| 15             | $(14) - (4) = D_f$                                       | <u>1.8795</u>           | 2.8654          |
| Comments ..... |  | Doubtful                | O.K.            |

$$D_c = \sqrt{D_b^2 + (2C \sin \emptyset - \sqrt{D_{oM}^2 - D_{bM}^2})^2}$$

- $D_o$  = Outside diameter;  $D_b$  = Base diameter;  
 $D$  = Pitch diameter;  $D_c$  = Diameter to lowest  
 $P_d$  = Diametral pitch;  $D_{oM}$  = Point of contact;  
 $\emptyset$  = Pressure angle  $D_f$  = Form diameter;  
 (for operating  $D_{bM}$  = Outside diameter of  
 angle in trans- mating member;  
 verse plane);  $D_{bM}$  = Base diameter of  
 $C$  = Center distance; mating member.

\* Size adjustment allowance for deeper contact due to involute error or backlash. If known, value should be used. If unknown, limit shown is suggested.

# Wet-Belt Grinding Finishes Variable-Pitch Pulleys

By WILLIAM E. HOPPOCK  
Industrial Engineer  
Sterling Electric Motors, Inc.  
Los Angeles, Calif.

THE heart of a mechanical variable-speed drive consists of a V-belt and two variable-pitch pulley assemblies. Consequently, two requirements—surface uniformity over the entire contact face of the belt pulleys and identical quality from pulley to pulley—are major factors in achieving top unit performance and in obtaining long belt life.

In an effort to meet these requirements and, at the same time, increase production rates, engineers of Sterling Electric Motors, Inc., Los Angeles, Calif., have investigated finishing methods other than conventional lathe and filing operations. As a result of this study, a wet-belt surface grinding machine, manufactured by Engelberg Huller Co., Inc., Syracuse, N. Y., has been installed. This machine provides a uniform surface finish of 32 micro-inches with a stock removal of approximately 0.010 inch. A self-contained motorized work-head is mounted on an automatic infeed table, as shown in the accompanying illustration. Aside from loading and unloading the work-head, the machine functions automatically.

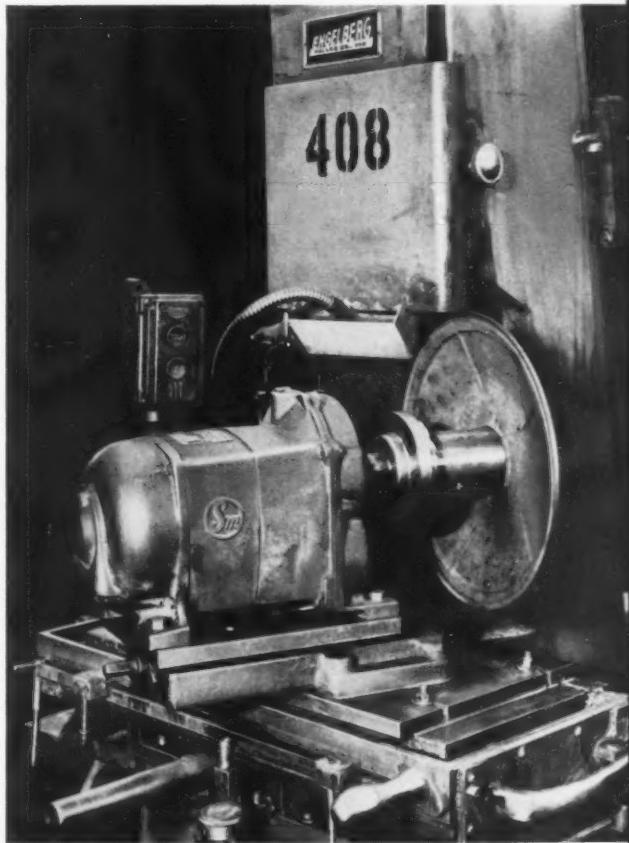
Use of the belt grinding machine has yielded a noticeable reduction—conservatively estimated at 20 to 25 per cent—in the time required to machine the pulley sections. Formerly, the belt-contact faces of the semifinished pulleys were filed smooth on the same lathe that was used to machine them. Following the lathe operation, keyways were broached in the bore of the part. With the installation of the new machine, the engine lathe is relieved of the surfacing operations, permitting it to be used only for machine-controlled work. After chucking a work-piece in the lathe, the operator is free to run the broaching machine and to load and unload the abrasive-belt grinder.

Pulley sections, which are annealed castings of a gray-iron alloy, are located on the work-head of

the machine by their bore and keyway. Pressure resulting from feeding into the abrasive belt is sufficient to hold them in place. In this way, the time required for loading and unloading is reduced to a few seconds.

From the loading position, the infeed of the machine provides a rapid approach to the grinding belt. A hydraulic cylinder controls the second, or machining, rate of feed, and a micrometer stop limits the amount of infeed travel. The angular position of the motorized work-head is securely locked at an 18-degree angle within a tolerance of 1/2 minute. Complete angular uniformity of the pulleys is maintained, thereby eliminat-

*Finishing the contact face of a variable-pitch pulley section on an abrasive-belt grinding machine. The surface is finished uniformly to an angle of 18 degrees within a tolerance of 1/2 minute.*



ing any rounding or other deviation of the contact face.

The pulley sections are rotated at a speed of 45 R.P.M., counter to the direction of abrasive-belt travel. A cam-actuated, table-oscillating attachment is powered by a separate motor and moves the rotating work back and forth across the face of the belt during the grinding cycle. The pulley thickness is reduced to a uniform cross-section. Maximum grinding time for the large size pulleys (15 inches in diameter with a 5-inch wide belt-contact face) is approximately sixty seconds.

An 80-grit, aluminum oxide, wet cloth type abrasive belt is used. It is 9 inches wide by 107 inches long and is operated at a speed of 5000 surface feet per minute. A self-contained coolant system not only supplies coolant to the grinding area, but also sprays it forcibly against the complete width of the belt as it passes below the machine table. This is done to insure rapid heat dissipation and efficient flushing of waste material from the belt. Abrasive-belt life is highly satisfactory, ranging from 300 to 350 pulleys before replacement is necessary.

## Vertical Storage Facilitates Handling of Sheet Steel

A minimum labor savings of thirty-six man-hours per day has been attained at the Aircraft Engine Division of Ford Motor Co., Chicago, Ill., through installation of a system for vertical handling and storing of stainless-steel sheet stock. Also, scrap due to handling damage has been reduced.

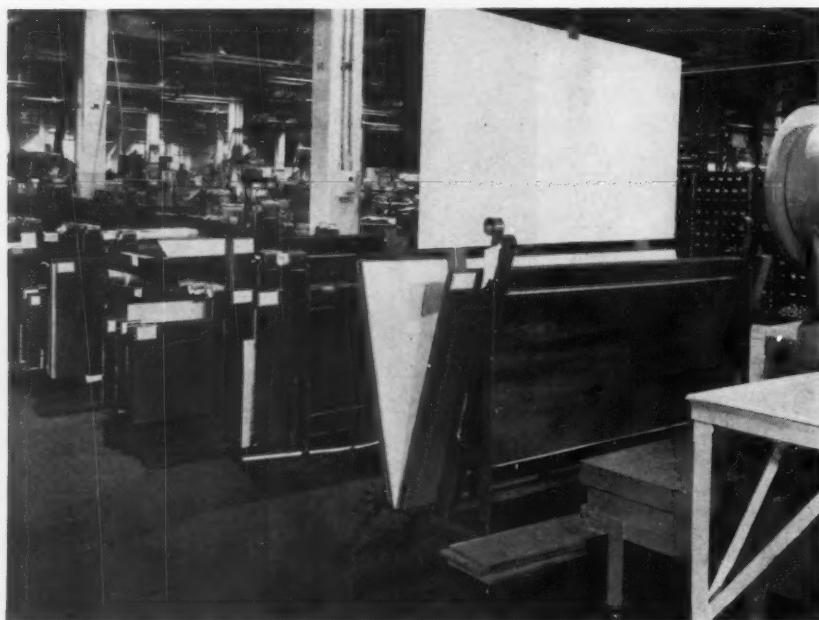
The sheets are stored on edge in protected "books," as seen in the accompanying illustration, which permit picking the required single sheets without moving or rearranging the remaining stock. Within the storage area, the sheets are separated according to composition, size, and heat code.

It is now planned to expand the system to permit direct transfer of stock from the receiving dock to the shear crib. The receiving inspection operation will be at the crib. This additional im-

provement will eliminate 2850 feet of required plant travel and three manual handlings of each individual sheet necessary under the current practice of handling the sheet stock.

### List of American Standards

In a list of American standards, just published by the American Standards Association, 70 E. 45th St., New York City, a total of 1600 standards are indexed. Included are standards for screw threads, small tools and machine tool elements, and bolts and nuts. The 56-page booklet also describes the work of the American Standards Association. Copies are available, free of charge, from the Association.



**Stainless - steel sheets — separated according to composition, size, and heat code—are stored vertically to facilitate handling.**

# Intricate Plastic Parts Formed by Precision Molding

By FRANCIS DeBARTOLO

Design Consultant  
Northrop Aircraft, Inc.  
Hawthorne, Calif.



A THREE-PHASE transition molding process for complex plastic components has been developed by the engineers of Northrop Aircraft, Inc., Hawthorne, Calif. With the new system, three types of material, each having a different melting point, are used to make precision plastic grids of the type shown in Fig. 1.

A block of metal such as Cerrobend, having a low melting point, is milled in a criss-cross pattern to the required depth to form the original female mold. The narrow, machined slots are then filled with an epoxy resin. After the resin has thor-

oughly hardened, the alloy is melted away leaving a casting of the first, or master part.

This master grid is completely covered with an elastomer, a rubber-like substance which, when set, forms a flexible mold. It can be used and reused to produce as many parts as are needed. Because the mold is elastic, the resin parts can be removed without regard to draft angles or undercuts. Resins used in the process permit tolerances of plus or minus 0.002 inch to be maintained.

Parts produced in this way cost only 4 per cent as much as those machined from aluminum. An

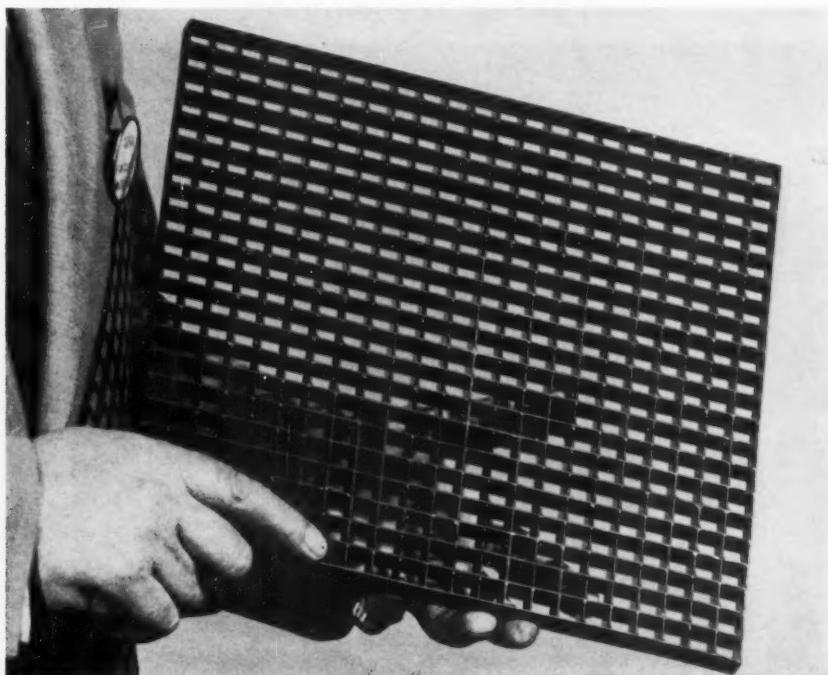


Fig. 1. This complex grid has been produced from epoxy resin by a three-phase transition molding process. The parts are held to a tolerance of plus or minus 0.002 inch.

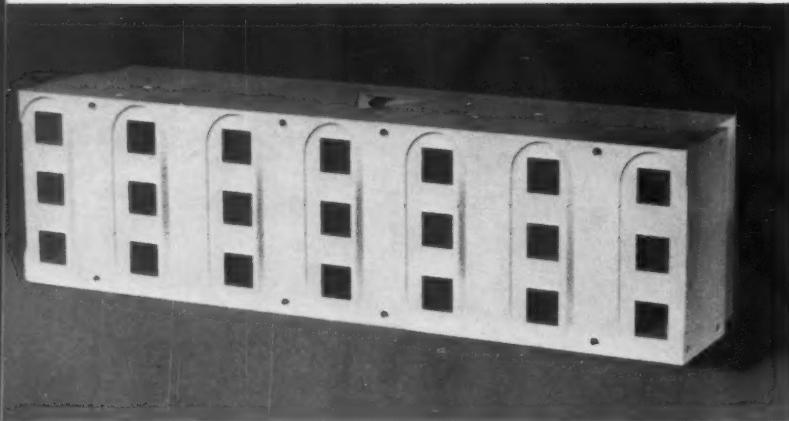


Fig. 2. Finished epoxy resin component for an optical testing device. The square openings seen here flare out sharply toward the opposite side of the unit leaving knife-edge walls between them.

additional economy is obtained by being able to recast the metal alloy that was used for the original mold.

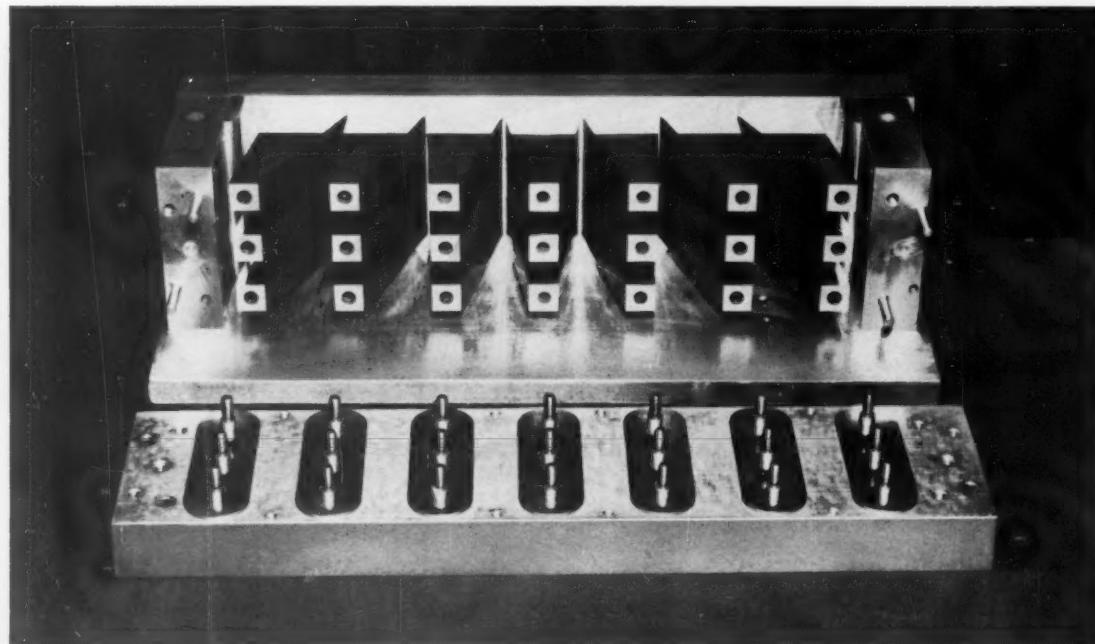
A precision component of an optical testing device being manufactured for the United States Navy is another part that is molded from epoxy resin. The unit, which can be seen in Fig. 2, not only is produced inexpensively and accurately, but is also given an optical finish.

Originally, it was thought to electro-form each segment of the complicated unit and then to assemble all segments into the desired whole. This method was not followed through, however, because it would have been costly and because all surfaces and dimensions were required to be

optically precise. As a result, a segmented mold, Fig. 3, was machined and assembled to the specified tolerances.

Resin is poured into an open side of the box, Fig. 4, and slush-molded, being sure that all interior surfaces are coated. Following this, the mold is placed in a vacuum chamber to expand the resin coating and to remove all air bubbles. As shown in the heading illustration, the mold is then filled with glass marbles. Their purpose is threefold—first, to reduce the heat developed by a chemical reaction of the catalyst in the resin; second, to prevent shrinkage of the part during the curing period; and third, to reduce the quantity of expensive plastic necessary, thereby reduc-

Fig. 3. Segments of this intricate mold have been lapped to a mirror finish for use in the production of optically precise plastic components. Knife-edges are accurately reproduced.



**Fig. 4.** Resin is shown being poured into the mold. After slush-molding, the entire box is placed in a vacuum chamber to remove entrapped air bubbles from the plastic coating and to cause it to expand.



ing the material cost approximately 80 per cent. The screws shown extending into the mold are removed after the resin has hardened.

Lack of shrinkage realized from the use of marbles and other additives results in a dimen-

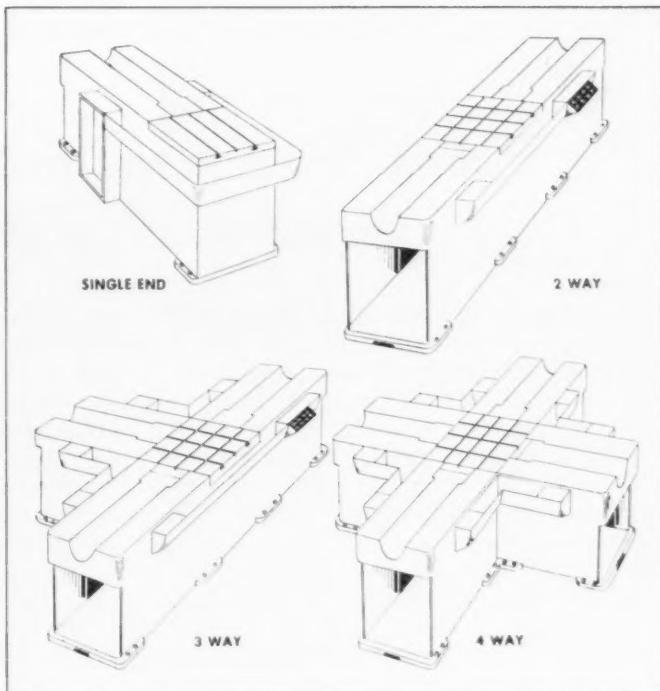
sional accuracy of plus or minus 0.0015 inch. All surfaces are optically flat, both round and knife-edge corners being faithfully reproduced. The finished parts are vapor coated with aluminum to give all surfaces a reflective finish.

## Machine Bases Tailor-Made to Meet Special Needs

By P. E. BUTZIN, Vice-President and Chief Engineer  
Simplex Machine Tool Corporation, Milwaukee, Wis.

Unit type precision boring machines are a major product of the Simplex Machine Tool Corporation, Milwaukee, Wis. Although certain standard models are available, nearly all machines have special features adapting them to the particular needs of the user. They are made with one to four, or more, boring-head slides, and bed arrangement may be single-end, two-way, three-way, or four-way, as Fig. 1 indicates.

Naturally, the major component of the machine is its base. It supports the slide or slides on which the boring heads with their drives are mounted, as well as any fixtures, brackets, or other special features. Ordinarily, the base houses a complete hydraulic unit and coolant



**Fig. 1.** Bases for unit type precision boring machines are usually arranged in one of the styles illustrated.

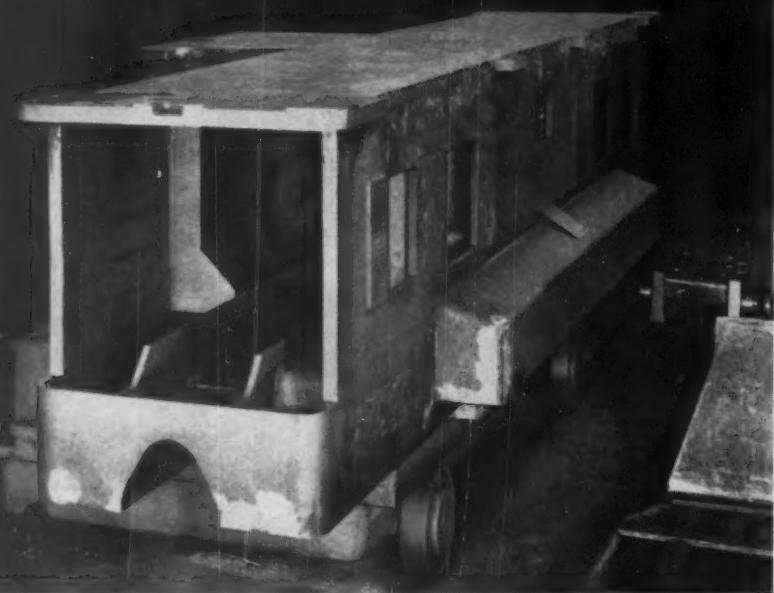


Fig. 2. The H-beam running the length of the weldment can be seen inside this base.

reservoir, although these can be located outside, if required.

Bases are made as weldments of 5/8-inch thick steel plate. A rigid rolled H-beam runs the full length of the base and is braced by top slabs as well as by ribs which tie it to the side walls and bottom plate. This construction can be seen in Fig. 2. Here, a base, in an inverted position, is shown after leaving the welding shop. Similar beams are added in side extensions for three-way and four-way machines. Pads or bosses are readily added as needed for attaching hydraulic units or brackets.

After arc-welding the bases with Lincoln Electric equipment, they are normalized and shot-

blasted. Necessary machining follows, and the work area and pads for mounting ways are scraped accurately. Hardened-steel carriage ways are then fastened to the top plates by screws.

Weldment bases have proved to be fully stable dimensionally, and are produced closer to size than castings would be, permitting a reduction in the amount of metal that has to be removed in machining. In some details, weldment machining is simplified by providing recesses, as for head hold-downs, that can be machined separately and then welded in place at small cost. Alterations to suit varying needs are simply made, and delays incident to pattern changes are avoided. Pattern and core storage problems are eliminated.

## "Silent" Sound Waves Finding Increased Application as Production Tool

It is anticipated that American industry, led by the Air Force, Navy, and Atomic Energy Commission, will buy more ultrasonic equipment in 1957 than in all previous years. The market for industrial application of ultrasonics—"silent" but powerful sound waves ranging from a frequency of 20,000 to 1,000,000 cycles per second—is expected to undergo a threefold expansion in the next twelve months.

Major applications for these sound waves in the production field will include drilling odd-shaped holes in carbides, ceramics, and other hard materials; cleaning and degreasing precision equipment; microscopically cleaning and steriliz-

ing surgical instruments immersed in cold water; decontaminating radioactive objects; degassing and grain refining of molten metals; soldering aluminum in the absence of flux; and detecting hidden flaws in metal. Paul M. Platzman, vice-president and general manager of Acoustica Associates, Inc., stated at a recent symposium held at the Yale Club, New York City, that the recognition of ultrasonic techniques by atomic energy authorities, university laboratories, and large industrial concerns has catapulted ultrasonics from a laboratory curiosity into a multi-million dollar industry today, and is expected to increase it many-fold in the foreseeable future.

# Thin-Wall Groove Cut with Special Tooling

FREQUENT adjustment of the cutting tool used for forming a groove in the face of a compressor-valve plate held production of the component to a negligible figure at the Commercial and Industrial Air Conditioning plant of the General Electric Co., Bloomfield, N. J. The valve plate, a punching of 1340 annealed steel, was being machined on an Acme-Gridley eight-spindle chucking machine. Due to insufficient rigidity of the grooving-tool support, springing of the 0.030-inch thick inner groove wall frequently resulted.

Attempts were made to adopt a trepanning tool as well as an opposed-tool setup, but without satisfaction. Finally, a combination of two tooling changes was devised that proved successful. One entailed the use of a tool that combined the properties of two different grades of carbide. The other was the use of a cartridge type tool-holder designed to be inserted in a tool-block mounted in the T-slots of the main tool-slide, Fig. 1. Use of this tooling setup brought the production level of the valve plates up to 350 to 400 per day.

The cutting tool—which can be seen together with an unfinished valve plate, a finished valve plate, and a cartridge type tool holder in Fig. 2—consists of a special shank of Carboloy Grade 55A carbide and a brazed cutting tip of Grade 350 carbide. The tip has a 3-degree side clearance, a 2-degree back taper, and is ground to the groove width of 0.093 inch plus or minus 0.001 inch.

Because the cartridge type tool-holder locates

the tool from only two sides, it is always in the same position when inserted into the tool-block. By having several tool-holders available they can be pre-loaded easily in the tool-room and be ready for insertion in the tool-block on the machine slide at a moment's notice.

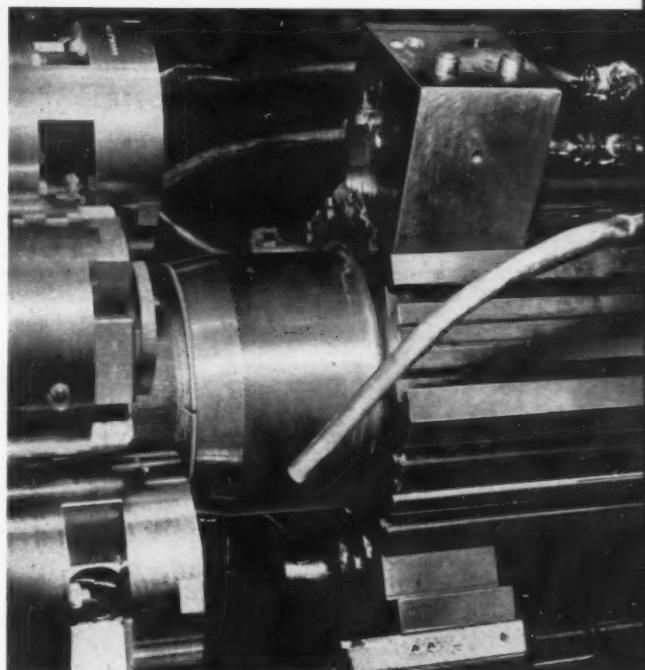


Fig. 1. (Above) Grooving tool protrudes from a cartridge type tool-holder. The tool-holder is secured in a tool-block on the main slide of an eight-spindle chucking machine.

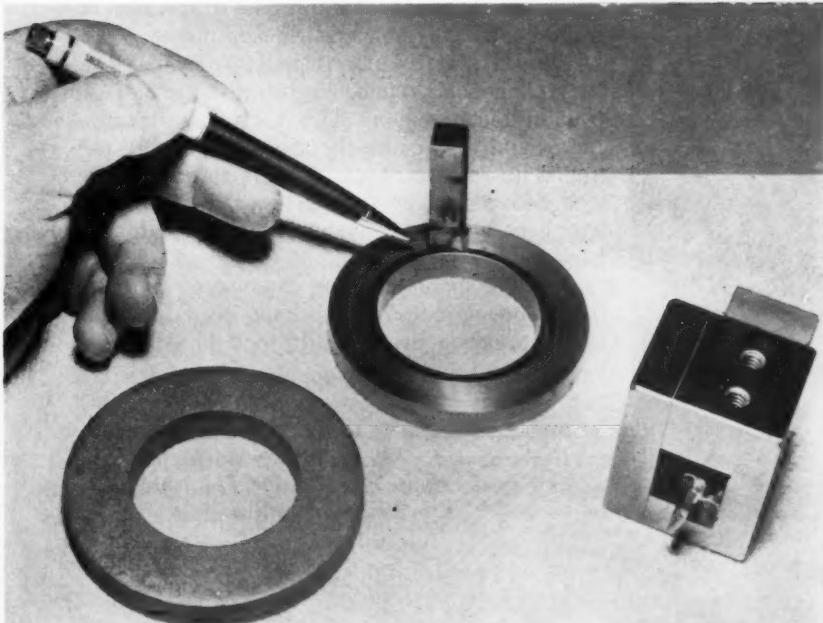


Fig. 2. (Left) Rough compressor-valve plate, left, finished valve plate with grooving tool in recess, center, and cartridge type tool-holder, right. Pads are placed between clamp screws and tool shank.

# Multiple Clamps Insure Accurate Heliarc Welding

By GEORGE BROLASKI and WELLS McGREGOR, Tool Engineers  
Convair, A Division of General Dynamics Corporation  
San Diego, Calif.

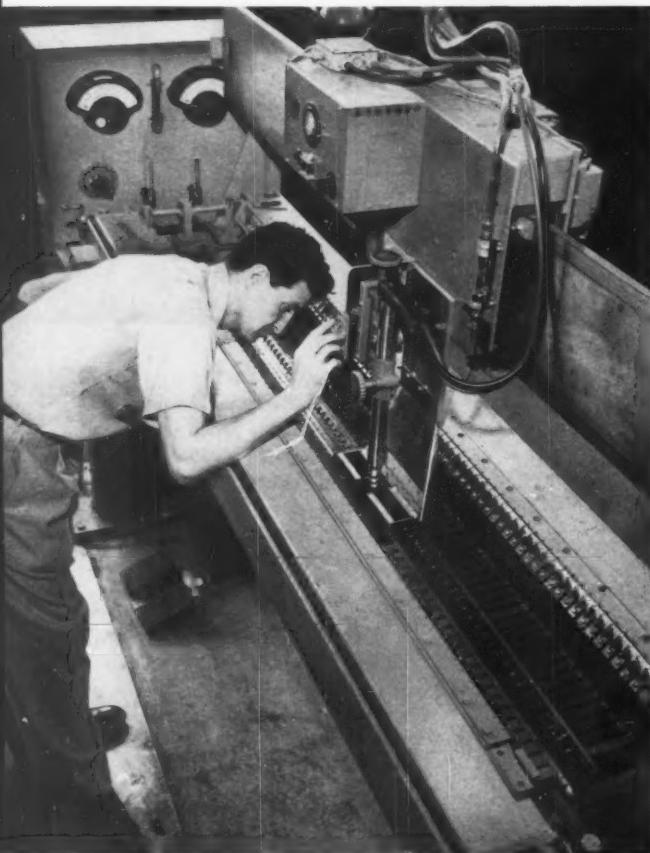
**S**TARTING in 1954, a new interest and impetus were given to welding at Convair. The very latest equipment and machines were procured. As there were no specialized fixtures and tools available commercially that would meet the required tolerances and standards, Convair manufactured its own. Design and fabrication of these fixtures were controlled by the tooling department, and installation, production sched-

uling, and early operation were supervised by its personnel. Each fixture was made for a particular job and equipped with a suitable power supply. As a result, quality production welding is now being accomplished.

Materials welded on the fixtures, to date, are titanium, high-nickel alloys, and many austenitic stainless steels. The thicknesses range from 0.004 to 0.100 inch. Experimental work on gages thinner than 0.004 inch shows promise. Metals thicker than 0.100 inch can be welded if a wire feeder is used to provide filler metal. Also, widening the gap between the clamps prevents burning or welding these holding fingers. Most of the machines are set to weld a given thickness of metal and are used for that gage only.

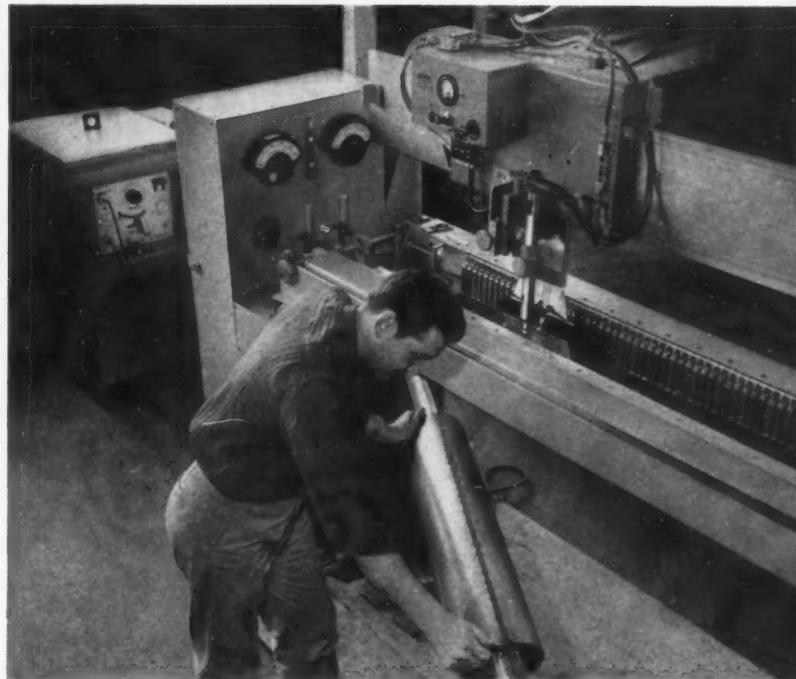
As in all Heliarc welding, argon gas, helium gas, or a mixture of the two in some proportion prevents weld oxidation. At Convair, argon is used almost exclusively for a backup gas to protect the under side of the metal. Helium or a mixture of helium and argon is used at the torch. Helium is also used at the higher amperages required for 0.030-inch and thicker pieces. When welding a part thinner than 0.030 inch, it was found beneficial to inject argon, at the rate of 3 to 5 cubic feet per hour. This gas seems to ionize better and thus cause the arc to start more rapidly. The volume of gas, for the torch, is fairly well determined by the thickness of metal. The length of weld is the controlling factor for the backup gas supply.

An 0.040-inch diameter, 2-per cent thoriated tungsten electrode, 7 inches long, is used for most of the welding in the 0.016-inch to 0.040-inch



**Fig. 1. Straight-line fixture for automatic Heliarc welding has multiple work clamps and an electronic control unit. Flat work or tubes may be welded.**

**Fig. 2. Welded part being unloaded from the swing-out backup bar of fixture seen in Fig. 1. Tubes down to 2 1/2 inches in diameter and 0.010 inch in wall thickness are handled.**



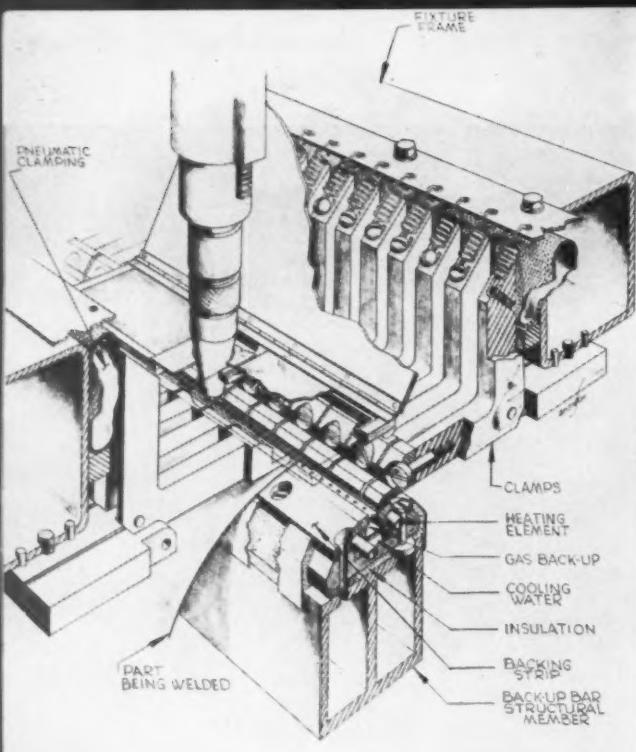
range. In some cases, a thicker electrode is tapered and used. This allows it to burn to the correct size for the necessary puddle and, hence, to do a good job of welding.

A constant welding speed of approximately 30 inches per minute was established for parts from 0.016 inch through 0.075 inch thick. With metal thinner than 0.016 inch, the speed is increased. On sizes 0.008 inch and thinner, a speed rate of 40 inches per minute is used. Metals between 0.075 inch and 0.100 inch thick require a 15-inch-per-minute welding speed.

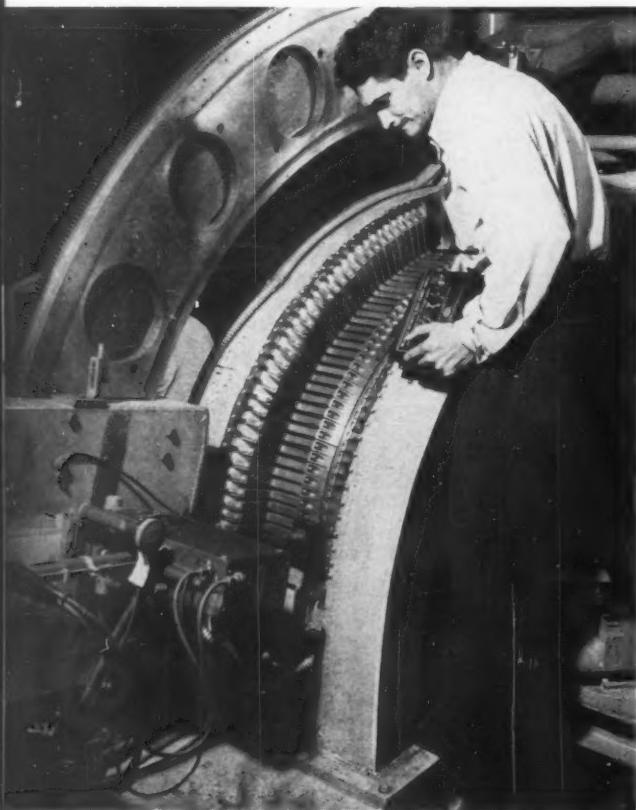
The machine in Fig. 1 is a straight-line butt welder used for light-gage tubing and sheet work. Fig. 2 shows the same machine being unloaded after completion of a weld on a 6-inch diameter work-piece. Tubes as small as 1 inch diameter and 0.010-inch wall thickness can be welded on this fixture. The power source is a 200-ampere direct-current Miller rectifier type welder with high-frequency and time-delay controls for water and gas. With continuous high-frequency operation, no trouble was encountered in starting or maintaining an arc of as low as 1/2 ampere. The weld was shielded with a mixture of gas containing six parts helium and one part argon. Thoriated tungsten has some advantage over pure tungsten for the welding of light-gage material with small-diameter electrodes. The side-beam carriage with electronic governor, which was obtained from Linde Air Products Company, provided a smooth and even rate of travel for the torch.

Components of the basic welding machine are shown in Fig. 3. The rigid fixture frame supports multiple clamps with minimum deflection. This construction assures equalized clamping pressure for the full length of the backup bar. Pneumatic clamping is applied by fire hoses. The stainless-steel clamps are 1 inch wide with as many as seventy-three located on each side of certain machines. These are employed for welds 6 feet in length. Use of stainless steel eliminates magnetic arc blow and pickup of contaminating elements. It also affords good wearing quality. Constructed to allow easy loading and aligning of the part, the frame permits unobstructed observation of the welding area.

Thermostatically controlled electrical heating elements provide uniform preheat and postheat for use on the heavier gages of some alloys. Cooling water is used during welding all light gages up to 0.064 inch thickness and insulation improves temperature control. A duct that is large enough to assure an even administration of back-up gas extends the full length of the bar. The backing strip is grooved 1/4 inch wide and 0.020 inch deep with No. 60 size holes on 1/2-inch centers. These holes provide for backup gas distribution. This strip, made of stainless steel, was proved superior to any made of the other materials tested. It was feared that parts would stick to the backup bar but this occurred very seldom. The backup bar construction permits it to swing out for loading and cleaning purposes.



**Fig. 3.** A typical section through a special automatic Heliarc welding fixture developed at Convair. Air pressure provides even distribution of the applied force among the finger-clamps.



**Fig. 4.** Vertical contour-welding fixture has a shield to cover arc. Operator does not need the usual protection.

**Fig. 3.** A typical section through a special automatic Heliarc welding fixture developed at Convair. Air pressure provides even distribution of the applied force among the finger-clamps.

Most stringent of all requirements in fabricating this machine was the 0.001-inch tolerance between electrode tip, carriage track, and backup bar measured when the clamping pressure was applied. Insistence that this close alignment tolerance be held has allowed the welding of material 0.012 inch thick and thinner.

Several sizes and kinds of nozzles and cups were tried. However, a Linde No. 8A ceramic cup, which is now used extensively at Convair, proved best. Smaller cups did not provide sufficient gas coverage, and metallic cups caused excessive arcing.

An arc and gas shield was developed to provide better gas coverage on the top side of the weld. The shield, which travels with the torch, is made of glass similar to that used in a welder's helmet. Fig. 4 shows the torch with the shield in place. It eliminates the welder's headgear, protects other people in the area, and acts as an inert-gas trailing guard. The latter gives the weld better gas coverage while cooling and, hence, a much cleaner weld is obtained.

The effect of roll planishing on Heliarc welds has not fully been determined. Considerable study and research disclosed that very little had been done with respect to roll planishing. Experimentation and research at Convair indicates that roll planishing increases both the yield strength and ultimate strength of the weld. A Convair test-laboratory report, on 0.018-inch gage Type 301 extra-hard stainless steel, reveals an increase of 30.5 per cent in yield strength and 3.6 per cent in ultimate strength. Using 0.036-inch gage, the rise of 47.5 per cent in yield strength and 9.8 per cent in ultimate strength was recorded. Other research performed in the shop showed similar results. However, due to the limited number of tests and samples per test, no conclusive statement can be made. It was discovered from the experiments made with roll planishing that a shrinkage of approximately 0.008 inch per weld can be expected. This factor has to be considered in design and engineering work.

In order to compare the tensile strengths of Heliarc welds in the as-welded condition and roll-planished condition, two pieces of stainless steel, Type 301 full-hard, 0.039 inch thick were welded. Approximately half of the trial weld was rolled while the other half was left as welded. Other tests were also made. The results of these trials are given in the accompanying table.

An automatic contour-welding machine is illustrated in Fig. 5. The material being welded is 0.030-inch thick, Type 301 half-hard stainless steel. The variation in the angle of welding is from 45 degrees upgrade to 45 degrees downgrade. A special feature of this and the machines shown in Figs. 4 and 6 is the Convair-designed side-beam carriage. Constant carriage speed up, level, and then down had to be maintained on certain contours without backlash. The required motion was achieved by using a Vickers hydraulic transmission driven by a 3/4-H.P. electric motor. A voltage-controlled automatic welding head limits the arc to a 1/4-volt variation. This is sensitive enough to allow the welding of a piece of material 0.005 inch thick.

In Fig. 6 is shown an automatic vertical welding machine. This equipment and the vertical contour machine, illustrated in Fig. 4, show the versatility of automatic Heliarc welding. As a result of this pioneering, Convair has gone into production using these welding positions. The advantages

**Fig. 5. Contour-welding fixture has side-beam carriage with constant-speed welding head travel, from a 45-degree angle upgrade to a 45-degree angle downgrade, without backlash.**



#### **Effect of Roll Planishing on Tensile Strength of Heliarc Welds Made on 0.039-Inch Thick Sample of Type 301 Full-Hard Stainless Steel**

|                                       | Tensile Strength, Pounds per Square Inch |               |            |
|---------------------------------------|--|---------------|------------|
|                                       | Low Value                                | Average Value | High Value |
| As-welded ...                         | 126,000                                  | 129,700       | 133,000    |
| Roll-planished                        | 142,000                                  | 143,700       | 147,000    |
| Increase due to roll planishing ..... | 16,000                                   | 14,000        | 14,000     |

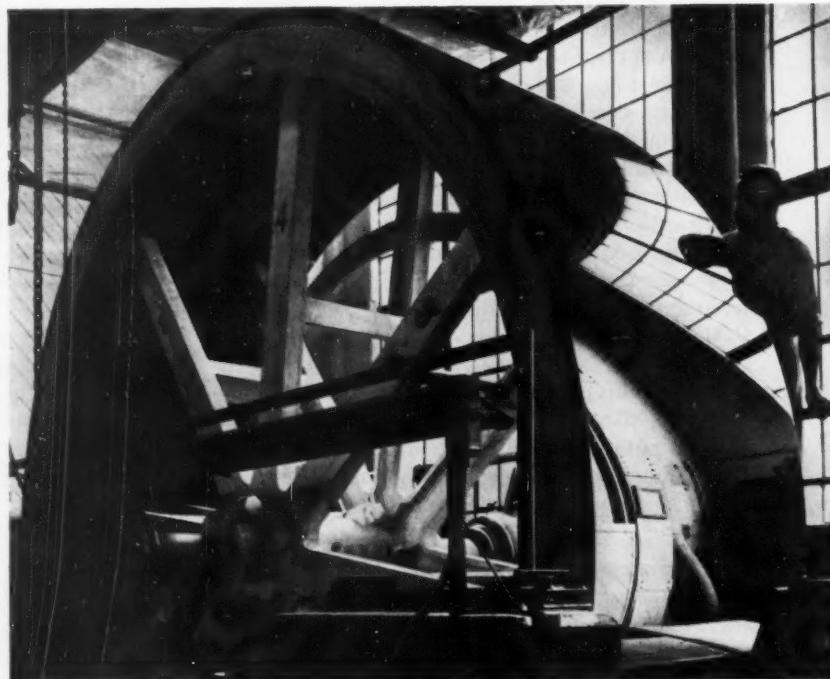
gained, tooling-wise, are tremendous. As a result, manufacturing space has been saved, the handling of parts simplified, and a better quality of weld attained. There have been very few repairs required on these fixtures. Since the introduction of the automatic machine for Heliarc welding, scrappage has been held to a minimum.

**Fig. 6. Vertical welding fixture that simplifies the handling of certain parts. A better quality of weld has been attained on work when it is held in this position.**



# Ultrafinishing—A New High-Precision Lapping Process

Many important innovations have been made which permit the use of lapping for the production of exceptionally smooth metal surfaces with precise geometrical control. The application of this process can yield a 0.3 to 0.5 micro-inch finish with an over-all geometry control equal to or better than any commercial finishing method. Abstract of a paper presented at the recent annual meeting of the American Society of Mechanical Engineers.



By T. G. LEWIS, Jr., Research Engineer  
Mechanical Development Laboratory  
E. I. du Pont de Nemours & Co., Wilmington, Del.

MANY manufactured products require high-quality surface finish. Such products as photographic-film base, plastic sheeting, and metal foils may require surface finishes that are comparable to optical surfaces. The most common method of providing these surfaces is one of duplication; that is, the finish is a replica of the surface of a processing component. The master finish is, in many instances, the surface of roll. However, commercial roll-finishing often does not yield all that is desirable for some applications.

Commercial processes generally fail to produce the optimum finish because of their inability to meet one or more of the required basic criteria, namely:

1. Good geometry control;
2. Cutting of inclusions without dislodging them;
3. Finishing pattern with a depth of a few tenths of a micro-inch;
4. Finishing all constituents of the metal to equal elevation.

The du Pont Company decided better roll fin-

ishes could offer an improvement in certain products and initiated an improved roll-finish development program, based on lapping. The work that followed showed that achievement of the objectives in high-precision lapping would be dependent upon the materials to be lapped. For relatively soft homogeneous metals of the electroplating variety, such as nickel, a low velocity is essential between the lap and the work. For hard heterogeneous metals, including alloys, a high velocity between the lap and the work produces the best results. Within the company, surfaces obtained by either of these new lapping methods are called ultrafinishes. Ultrafinishing is basically a modified lapping process. Fig. 1 shows the five components of lapping:

1. The lap is that part which applies a force to the abrasive particle causing it to abrade the work and itself.
2. The work is a surface to be refined to meet certain geometrical requirements. The refinement may be for surface finish only, or it may be for both surface finish and geometrical precision.

3. The vehicle is generally a liquid in which the abrasive particles are suspended. It also affords a film between the lap and the work.
4. The abrasive is a granulated substance having sufficient hardness to abrade the work and the lap.
5. The pattern is the configuration of the relative motion between the lap and the work.

Ultrafinishing is a series of patented techniques which differ from conventional lapping in one or more of the following respects:

1. The lap is restrained about one or more axes with respect to the surface being finished.
2. Control is exercised over the rate of change of shape of the lap by selection and combination of materials.
3. Critical attention is paid to the abrasive-supporting surface of the lap at each of the several stages of the lapping process.

#### **Low-Velocity Ultrafinishing for Soft Homogeneous Material**

This method is characterized, as the name implies, by the relatively low velocity, which rarely ever exceeds 300 surface feet per minute. It is applicable to electroplated copper and nickel.

A good perspective of the process may be developed from the description of the finishing procedure for a wheel 15 feet in diameter by 60 inches wide, which is seen in the heading illustration. The cylindrical face of the casting wheel is

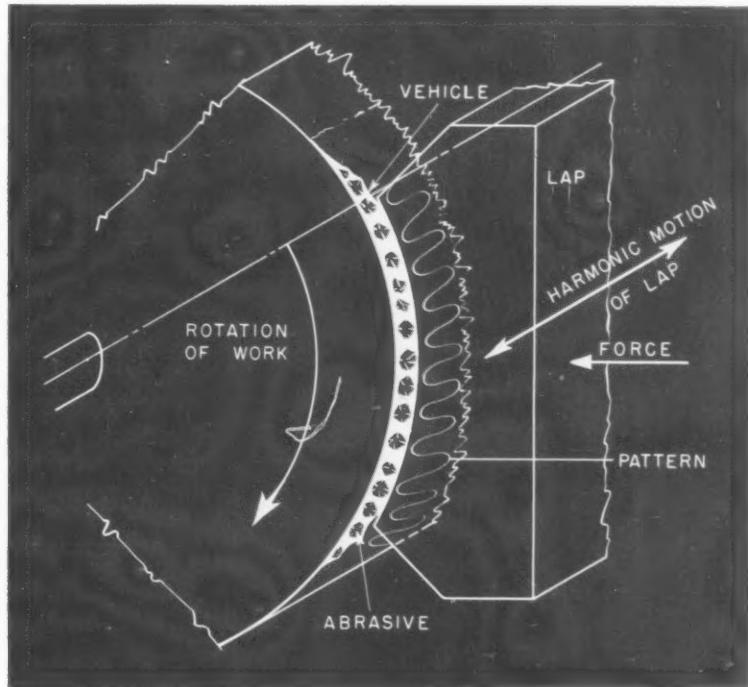
electroplated with about 0.040 inch of copper, followed by 0.025 inch of electroplated nickel. At the completion of each plating operation, ultrafinishing is performed.

Ultrafinishing is a progressive process starting with a coarse abrasive and, in each succeeding step, advancing to a finer abrasive. In this case, 320-grit aluminum-oxide abrasive is used in the initial step, with tool steel hardened to Rockwell 60 C as laps. This is followed with 400- and 500-grit abrasive, with additional refinement of surface in each step. At the completion of the 500-grit step, the tool-steel lap is removed and replaced with pitch-backed fabric lap.

The fabric-lap phase is composed of two steps: (1) a pile type wool fabric is used with levigated alumina as the abrasive; and (2) the wool fabric is replaced with silk of similar construction, and Linde polishing powder is used as the abrasive. Throughout the ultrafinishing of the wheel, sperm oil is used as the vehicle. The lapping equipment provides a sinusoidal pattern. The ultrafinish in this instance is about 0.5 micro-inch, and the over-all geometry is within 0.002 inch of an ideal cylinder.

Probably the most critical requirement of the lap is uniformity of structure of the material. Tool-steel laps have given the most consistent performance. An inclusion in the lap can be a source of contamination of the vehicle-abrasive suspension, in the form of relatively large, dislodged particles. If the size of the dislodged par-

**Fig. 1. Essential components of lapping include the lap, the work, the vehicle, the abrasive, and the pattern.**



ticle is larger than the abrasive particle, damage is done to the work in the form of a deep scratch. Thus, low-inclusion content or wide dispersion of inclusions having a small size is desirable. In some instances, laps with relatively large inclusions perform well; but the element of risk is much greater.

Nonuniform abrasion resistance is a condition that causes a lap to have an uneven rate of wear and can cause the development of a high spot in the lap surface. Since the lap must bear on the work, this high spot may break through the film afforded by the vehicle. If this occurs, galling between the lap and the work may take place; thus damage is done. Another troublesome aspect of this condition is the effect upon the geometry of the work. The high area of the lap produces a counterpart in the work, which is made relatively low to the average work surface. This lap fault is generally found in metals other than tool steels, such as copper and lead.

A pitch-backed, fabric type lap is shown in Fig. 2. This lap is essentially a cast pitch block 1/2 inch thick, enclosed in an envelope of oil-proofed canvas. The canvas is any of several types sold by tarpaulin manufacturers and sailmakers. After fabrication of the canvas envelope, it is coated with about three applications of shellac to make it oilproof. The block is inserted, and the remaining open side of the envelope is

sewn to make a complete enclosure. This enclosure is attached to the lap holder through flaps. In use, several polishing fabrics will be used; so a separate means of attachment of the fabric is provided to allow for fabric changes without disturbing the envelope.

This pitch-backed, polishing-lap arrangement is very important to low-velocity ultrafinishing. It affords an easy means of shaping the lap to the wheel curvature. As the lap is loaded, the pitch will slowly flow to take on the roll curvature. The pitch also serves another purpose in promoting good wheel geometry. The fact that it conforms to the wheel curvature at a relatively slow rate is very important. This characteristic prevents the polishing of any low or depressed area that otherwise would come about by virtue of the metal surface being somewhat less abrasion resistant in certain areas.

For optimum results with the pitch-backed, fabric lap, the fabric must be of a pile type construction with the pile fibers turned back into the base material. Those fabrics with the pile fibers terminating at the surface are not satisfactory as they encourage an "orange peel" condition. The pile type construction allows for wear without the fabric falling apart. Wool and silk fibers yield the best results. However, silk is used only in final finishing for economy.

The ideal lapping equipment would allow for complete self-alignment of the lap to the work. To do this, the lap would have to span about a 60-degree arc of the roll surface. For large rolls, the lap size would be of proportions that would demand lap forces estimated at many tons. The actual arc of contact used is about 12.5 degrees. Fig. 3 is a schematic drawing showing the lap and the work and three axes each 90 degrees from the others about which the lap alignment may be obtained. Complete lap self-alignment would allow freedom of movement about all axes. However, with small angular contact, freedom of movement about ZZ cannot be tolerated. Slight variations in friction can cause the lap to become skewed with the edges of the lap digging into the work. With restricted movement about ZZ, good finishing could be obtained together with excellent geometry control.

As part of the lap-mounting requirements, one must consider means of applying to the lap a force normal to the work. This force should be sufficient to yield a unit loading between the lap and the work at about 10 pounds per square inch. Helical springs and pneumatic cylinders are convenient for this purpose. This force system is usually calibrated so that the operator can work at unit pressures from 3 to 10 pounds per square inch.

Fig. 2. Pitch-backed, fabric type lap used for ultrafinishing. Cast pitch block is enclosed in a canvas envelope.

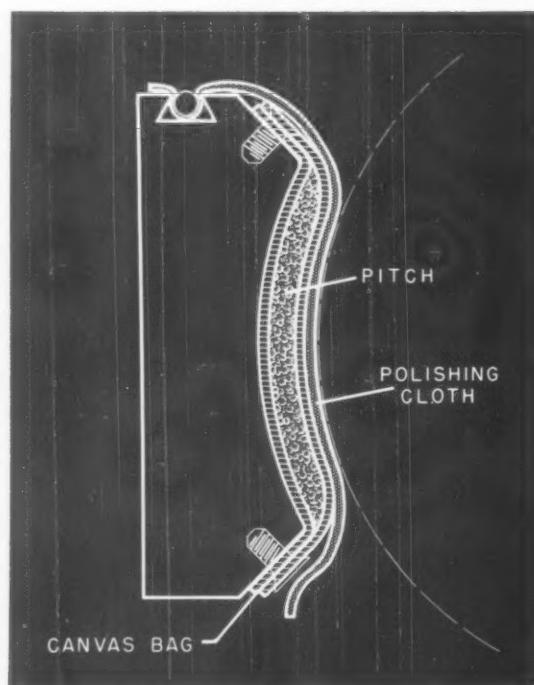
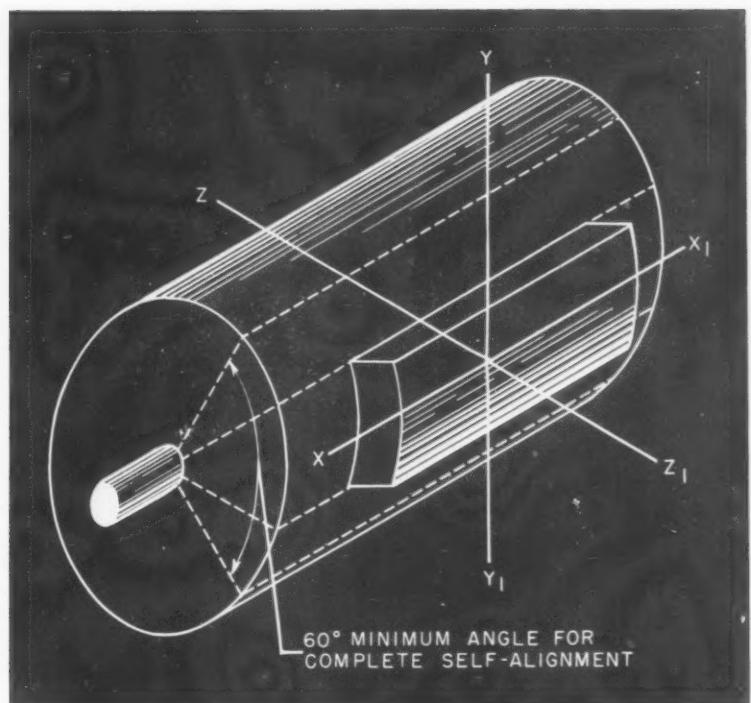


Fig. 3. Schematic drawing of lap and work showing three axes, 90 degrees apart, about which lap alignment may be obtained.



Lap rigidity must be given due consideration. In general, the lap may be considered as a uniformly loaded beam with sufficient rigidity to resist deflection beyond the tolerance of the contour of the roll. In the lap mounting on the 15-foot diameter wheel, two pneumatic cylinders exerting a total force of 7200 pounds were spaced along the lap length, 0.223 times the lap length from each end. These mounting proportions give a deflection at the center equal to the deflection at each end. Also, such proportions give maximum rigidity with a minimum of mass.

The self-aligning features of the lap make it an unstable element when not bearing on the work. On contact with the work, stability is established, and even unit loading is maintained only as long as properly designed forces are acting upon the lap. Care must be taken to prevent additional forces from acting on the lap that would cause a nonuniform loading. Such unwanted forces can arise from couples introduced by having the lap-driving forces acting outside of the center of gravity rather than through it. Also associated with uneven loading is the frictional force of lapping. If these forces do not act through axes that provide self-alignment, a torque is introduced causing uneven loading. In a practical design, slight unevenness of loading must be accepted. However, one must be careful that it is not excessive.

In large surface laps, the oil film afforded by the vehicle can build up to thicknesses greater

than abrasive-particle size and prevent cutting. This condition may be alleviated by making serrations in the lap surface. In general, serrations in the form of grooves cut in the lap face, parallel to the axes of the roll, and spaced about 3 to 4 inches apart, are satisfactory.

Lap length is also of importance. To start with, the lap should be the same length as the roll face. However, if after extended lapping the roll tends to become crowned, the lap should be made slightly shorter. If the reverse is true, a slightly longer lap is required. These variations have been noticed from one lapping setup to another, and the exact cause of crowning or concaving is not clearly understood. But once the proportions of lap length to work face have been adjusted satisfactorily for a given setup, readjustment is seldom necessary.

Aluminum-oxide, crystalline type abrasives are almost exclusively used in low-velocity ultrafinishing. Important qualities of the abrasive are uniformity of grading, toughness of particle, and sharpness of particle. Uniformity of grading allows for the most uniform finish with fastest metal-removal rate. Toughness of abrasive particle improves cutting rate by virtue of the particle retaining its original form for a comparatively longer period of time. When microscopically examined, some abrasives exhibit a sharper appearance than others. Particles spherical in shape do not exhibit a cutting rate as good as particles of a polyhedron configuration. In special applica-

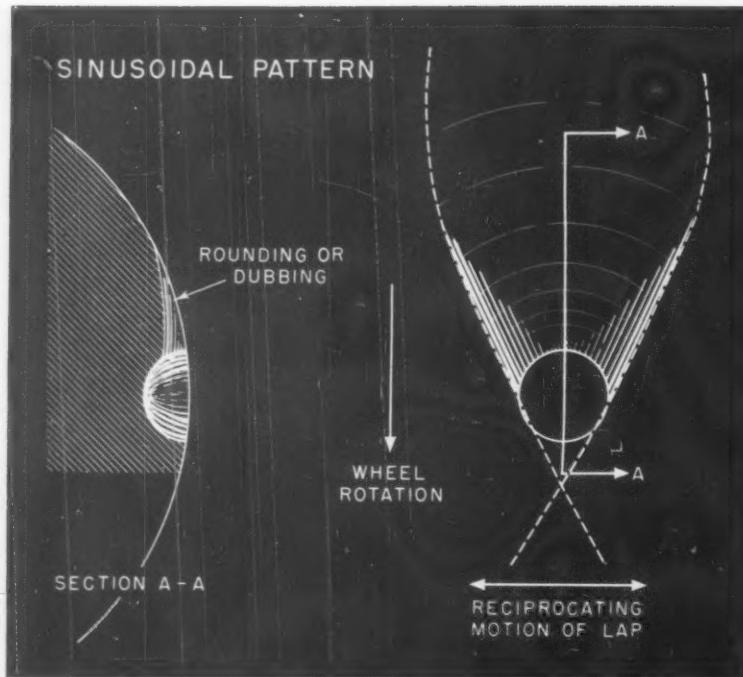


Fig. 4. With a sinusoidal lapping pattern, rounding is predominant only on a portion of the edge of the void.

tions, other abrasives such as diamond, boron carbide, emery, iron oxide, magnesium oxide, and many others can show excellent performance. These ratings are based on the performance on electroplated copper, electroplated nickel, and other metals of similar structure.

Vehicle oils of animal or vegetable origin have yielded the best finishes. Olive oil, peanut oil, and sperm oil have been used with about equal success. Olive oil may be slightly less desirable because of higher cost and higher viscosity. Sperm oil is ideal from a cost standpoint, but it has an odor that is offensive to some. This undesirable trait may be removed by adding a deodorant. Peanut oils are more expensive than sperm oil, but results are identical. Also, mineral oils have been tried with moderate success. The disadvantages become more pronounced as the finish becomes higher. The economies that could be afforded by using mineral oils have prompted efforts of doctoring them with additives. However, slight success has been noted.

The qualities of a vehicle that determine its performance are its wettability and viscosity. The vehicle should exhibit good wetting characteristics for the work, the abrasive, and the lap. Fulfillment of this promotes a uniform film at the lap-work interface, and it also affords uniformity of abrasive-particle concentration in the vehicle. Viscosity should be low rather than high. This allows for a lower power consumption in doing the work. There are other indirect benefits, namely: lower temperature gradients, which

make geometry control easier to handle; and lower lapping pressures, which cause less distortion and, hence, provide improved geometry. In a continuous finishing process, the vehicle performs still another function—as a carrier for the used broken-down abrasive particles and the cuttings coming from both the work and the lap.

The proportions of abrasive to vehicle are important. When starting with low concentrations of abrasive, and gradually increasing the concentration, the cutting rate would increase. However, if carried to extremes, a point would be reached where the process would become erratic and the general quality of finish would deteriorate. The ideal ratio of abrasive to vehicle is one that produces the fastest cutting rate without sacrificing quality of surface finish. Also, should this procedure be carried out for various grit sizes, the optimum concentration would be found to vary with the grit size. After gathering data relative to abrasive concentration versus abrasive-particle size, it has been found that a relationship exists that can be expressed mathematically. If the various grit numbers are plotted on the abscissa and the weight of abrasive per unit volume of vehicle is plotted on the ordinate, the curve so plotted approximates a hyperbola. The equation is:

$$y = kx^{-2/3}$$

where,  $y$  = weight of abrasive per unit volume of vehicle;

$x$  = grit number of abrasives;

$k$  = a constant.

The constant is developed from experimental data. The grit number is the standard method of designating abrasive-particle size.

For aluminum-oxide abrasive in sperm oil for use with metal laps, the equation is:

$$y = 500x^{-2/3}$$

where,  $y$  = ounces of abrasive per gallon of sperm oil;

$x$  = grit number;

500 = a constant.

This relationship does not hold when using fabrics as a polishing element. Generally, the optimum proportions show a greater amount abrasive to sperm oil than would be predicted by employing the equation.

Quality of the plating on the work must be considered. If there are voids in the plating, their presence will be accentuated by the process. As a result of the relatively low smearing characteristic of ultrafinishing, the deposit must be sound for a blemish-free surface. The work also must be sufficiently rigid to withstand the forces exerted upon it by the process. The work, like the lap, should be reasonably free of inclusions.

The importance of the pattern configuration depends upon the soundness of the work surface. In cases where metallurgical defects are of low order, almost any random pattern is satisfactory. The determining factor may be the economics of design. However, when the number of metallurgical defects is relatively high, certain patterns do a better finishing job than others. This is particularly true when the defects are voids. Low-velocity untrafinishing rounds the edges of voids to varying degrees, depending upon the combination of a number of factors. Lap resilience, concentration of abrasive, and pattern have the most predominant effects.

In the process of finishing electroplated surfaces, the resilient fabric polishing element rounds the edges to a high degree. This accentuates the defect; however, proper pattern selection will minimize this effect. With a sinusoidal pattern, as indicated in Fig. 4, it is noted that rounding or dubbing is predominant only on a portion of the edge of the void. Of the patterns used, this one is least desirable. The rounding is deep and extends from the void many times its diameter. On the other hand, a circular pattern, as indicated in Fig. 5, is considered best, but is the most expensive to provide. It can be seen that rounding occurs completely around the void, but the depth of the rounding is much

more shallow than that found with the sinusoidal pattern. Furthermore, the area of the rounding is less for a circular pattern.

### High-Velocity Ultrafinish for Hard Heterogeneous Alloys

Alloys such as 440-A stainless steel do not respond to ultrafinishing at low velocities. Troubles arise from dislodged carbides and inclusions. In efforts to overcome the difficulties, many changes were made in the components that make up the process. To explore the higher velocity ranges it was realized that a radical change in technique would be required. Up to this time, the maximum relative velocity was 600 surface feet per minute. Inertia forces in the lap and lap mounting were difficult to deal with at higher velocities.

The arrangement shown in Fig. 6 was considered the most logical approach to higher velocities. The machinery involved was, for the main part, a cylindrical grinder modified to comply with lapping. The grinding-wheel spindle was removed and replaced with a motorized spindle, mounted so that its axis of rotation was 0.7 times the radius of the lapping wheel above or below the work axis. Also, the axis of the motorized spindle was 90 degrees to the normal orientation of the grinding spindle. With proper alignment of the spindle to the work, two working interfaces were brought about. If the axis of rotation of the

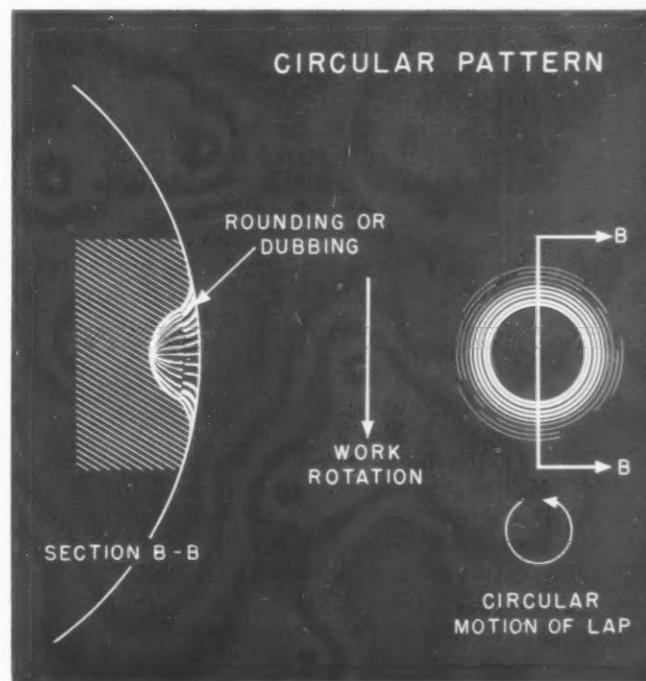
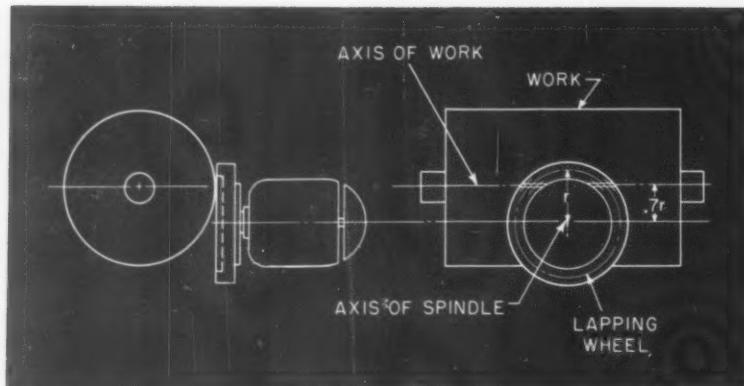


Fig. 5. Rounding occurs completely around the void when a circular lapping pattern is used, but this pattern is expensive.



**Fig. 6. Arrangement of work and lapping wheel for high-velocity ultrafinishing consists essentially of a modified cylindrical grinder.**

work and the axis of rotation of the spindle are horizontal, then the direction of cutting at each interface is approximately 45 degrees from a vertical center line. Thus, the direction of cutting at each interface is approximately 90 degrees to the other. This affords pattern breakup.

The work revolves at about 20 surface feet per minute, while the lapping wheel is traversed across it at a speed to cause a slight overlap of pattern. At each end of the roll, one working face is allowed to travel beyond the roll end so that the remaining interface just covers the roll end. The lapping wheel has a relative velocity of about 9000 surface feet per minute. Abrasive is applied to the work suspended in a vehicle in the same manner as it is in the low-velocity process. Processing is progressive—starting with coarse abrasive and working through succeeding stages of finer abrasives. When this process was tried on a 440-A stainless-steel roll, it performed well, cutting the carbides and inclusions without dislodging them.

The lap reached its present stage of development after many materials were tried. Initial work was done with metals, followed by plastics, and then wood. After investigating a variety of species, it was found that lignum vitae, a tropical wood, was far superior to any of the others. It is different in structure from most woods, having a specific gravity of about 1.2 and containing about 25 per cent resins by weight. In the use of this wood, several observations indicated that the resins of the wood were largely responsible for its unusual behavior.

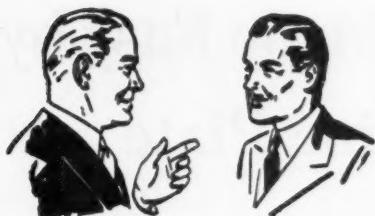
After trying a variety of abrasives, it became obvious that diamond was the only useful one. The results with the more common abrasives were varied. In some instances, cutting was nil; in others, the lapping-wheel wear was rapid. The vehicle behavior in this process approximately parallels the results obtained for the low-velocity one. Animal and vegetable oils exhibited better results, with olive oil showing a slight superiority.

In the work done thus far, the high-velocity process has shown good finishes when applied to materials typical of 440-A stainless steel, X-alloy, SAE-52100, 316 stainless, 304 stainless, BR-4 tool steel, Stellite, and 17-4 PH alloy. With this variety of materials responding to the process, it is reasonable to believe that many other materials not yet tried will respond equally well. Roll or wheel design must allow for internal cooling where the ultimate in geometry is desired. With internal cooling, one can produce geometry equal to that of the best grinding.

As already mentioned, the pattern breakup for this process is afforded through the location of the work axis with respect to the lapping wheel spindle axis. The ideal condition is to have cutting at one interface 90 degrees to cutting at the other interface. The degree of departure from the ideal without compromise varies with work materials. In finishing 304 stainless steel, the variation in angle of cutting may be wide with little noticeable effect. But with 440-A stainless steel, this angle should be held between 60 and 120 degrees.

#### **Surface-Finish Measurements**

In the early days of this work, surface finishes were evaluated by the stylus type instrument; but it was soon realized that some very fine details of surface character could not be evaluated because of the size of the stylus. So, an instrument called the multiple-beam interferometer was developed for surface-finish measurement. This allowed surface detail less than 1 micro-inch in depth to be observed. With such an instrument, the surface finish of both the low- and the high-velocity processes are evaluated. If sound material is at hand, both of these processes can yield a surface finish of 0.5 to 0.3 micro-inch. It is believed that with the present knowledge of finishing and with better work materials it is possible to ultrafinish to 0.1 micro-inch.



# Talking With Sales Managers

By BERNARD LESTER  
Management Consulting Engineer

## Organization Charts Are a Puzzle

THE organization chart is a long used but often abused instrument of management, which has not kept pace with the improvements in management itself. In our eagerness to analyze and record by symbols, we easily overlook the aim. Ask the average top executive the purpose of his organization chart and all you are likely to get is a knowing look. But if you persist, his answer is often tragically weak. When he says its purpose is to show those interested how his organization works, his reply is superficial.

As a result, a most popular use of the widely circulated organization chart, covered with many names, is to induce jokes. Some employe asks how you decide whether to string up the bosses in transparent oblong or square boxes, or in spheres. Another suggests that the ascending list of names shows how far the climb and who blocks the way. "The higher the fewer, and the greater the fall" is a common jibe. Someone reading the titles exclaims: "The boss needs a course in semantics!" And almost everyone admits that the chart usually hangs dust-covered on some official's wall—quite out of date.

Back in the heads of a number of executives is the shadow of a fantastic idea that if you have a good organization chart, you have a good organization. A chart does not show what men actually do, how they do it, whether they are content or frustrated, or their relative value to the company. It does show concentration of power and it does indicate the flow of authority through communication, just like an electric circuit.

Having damned the organization chart, now let's come to its rescue, for it has superior advantages. It can be necessary and useful. Its greatest benefit does not come from the finished chart, but from the *making*. You can't make a good chart unless you have first developed a good organization. Charting is a very useful tool if preceded by knowledge, skill, and wisdom way beyond that required in preparing a graphic presentation.

The up and down form of chart, which implies that wisdom and power flow from above, is open to real criticism. Some years ago we proposed turning the chart upside down. On top insert the real boss—now absent from every chart—the all-important *customer*. Next, those who serve him by their daily effort. Finally, at the bottom are the president and the board, who support the whole group essential to serving boss-customer.

An alternate general form of arrangement that avoids the prejudices caused by establishing up and down levels is to lay the chart on its side. Customer to right, corporate authorities to left. In between, the various steps of responsibility in the onward course toward customer satisfaction.

Coming to the details of the chart, we must decide first the use of the chart and the extent of its distribution. The employe, irrespective of his rank, views the chart not only in the abstract, but in relation to himself. To be complete, the chart should show functional responsibilities and objectives, the names of persons, a job description of each, and a description of the relationship between them. Such an assembly of data is impractical.

The organization chart for popular distribution should omit names and show stations of responsibility and obligation, briefly described. These stations are connected by "wires of communication" that are actually used both ways. In such a form its wide circulation can be a constructive part of personnel relations, provided both its purpose and its practical meaning are made plain. A leading purpose of the chart does not relate to authority, but rather to the generation and flow of ideas from many persons and stations to few.

In the hands of management, a personnel chart with titles and job specifications serves as a tool to implement the principle of the right man in the right place. And, above all, it should promote a study of ways and means to help the man assigned to the job become exactly the right man.

# Compound-Angle Setups Made Easy by Unique Three-Ball Sine Plate

By JAMES R. HANSEN, Bellevue, Wash.

THE setup for machining or inspecting compound angles on jigs, fixtures, cutting tools, and work-pieces can be simplified considerably by employing the novel, three-ball sine plate assembly shown in Fig. 1. Basic components of this precision tool are three commercial tooling balls *a*, *b*, *c*, and a flat steel plate. The following example will show how this sine plate is used in an inspection setup to check a compound angle.

The block in Fig. 2 is used as a banking pad in a milling fixture, the face of the pad having edge angles  $A = 20$  degrees and  $B = 30$  degrees, as shown. Three corners of the pad have been labeled *a*, *b*, and *c* to agree with the *a*, *b*, *c* designations of the balls on the sine plate. This manner of designation is a matter of convenience in keeping track of how the edges of the pad are aligned

with the edges of the sine plate in setting up a compound angle.

In Fig. 3, the pad is shown fastened to the top face of the sine plate so that edge *ac* of the pad is parallel to edge *ac* of the sine plate. Thus, the side of the pad with the 20-degree angle is along the *ac* edge of the plate. This edge, when pushed against the face of a 90-degree angle-plate, corresponds to a side of the base of a conventional compound-angle sine plate. Supporting ball *a* is rod  $H_a$ , 1.5031 inches long. The rod  $H_b$  under ball *b* is 2.3844 inches long, and ball *c* rests directly on the surface plate or, in the case of a machining operation, on the machine table. If the compound angle on the face of the pad is correct, an indicator will show the face to be parallel to the surface plate or machine table.

The lengths of the rods  $H_a$  and  $H_b$  are calculated by using three simple formulas which, in conjunction with Fig. 2, can be used to set up any compound angle.

$$\tan C = \tan A \times \cos B \quad (1)$$

$$H_a = 5 \times \sin C \quad (2)$$

$$H_b = 5 \times \sin B \times \cos C \quad (3)$$

Angle *C* is determined from the first of these formulas. This angle, not shown in any of the illustrations, is required for use in Formulas (2) and (3) and otherwise is of no importance in setting up the compound angle. The factor 5, which appears in Formulas (2) and (3), represents the distance between ball centers on the sine plate.

In applying Formulas (1), (2), and (3) to the setup in Fig. 3, the first step was to determine the angles *A* and *B*. Fig. 3 shows that the 20-degree angle on the block is on the *ac* edge of the sine plate. This angle therefore is angle *A*. The 30-degree angle on the block is angle *B*. Thus,

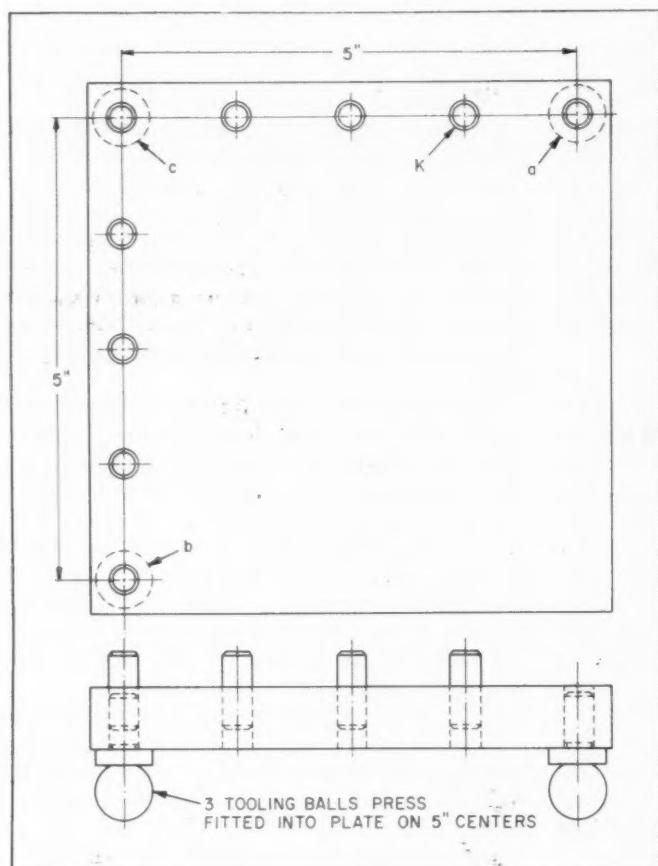


Fig. 1. The basic elements of this compound-angle sine plate are three tooling balls (*a*), (*b*), and (*c*) press-fitted into a flat plate.

**Fig. 2. Block used as banking pad in milling fixture. The compound angle of the face of this block is specified in terms of the edge angles of the block.**

$$\begin{aligned}\tan C &= \tan 20^\circ \cos 30^\circ \\ &= 0.36397 \times 0.86603 = 0.31521\end{aligned}\quad (1)$$

so that  $C = 17^\circ 29.71'$

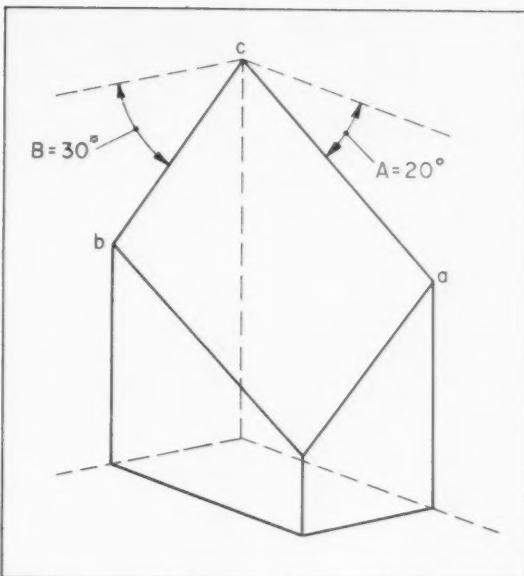
$$\begin{aligned}H_a &= 5 \times \sin 17^\circ 29.71' = 5 \times 0.30062 \quad (2) \\ &= 1.5031 \text{ inches}\end{aligned}$$

$$\begin{aligned}H_b &= 5 \times 0.50000 \times 0.95373 \quad (3) \\ &= 2.3843 \text{ inches}\end{aligned}$$

If it is necessary to make an "opposite hand" setup, that is, a setup for a block having angles  $A$  and  $B$  interchanged, it is not necessary to calculate new values for  $H_a$  and  $H_b$ . Merely interchanging  $H_a$  and  $H_b$  will do the job. This reverse setup is particularly useful in the aircraft industry when "opposite" parts are to be made.

All that is necessary to set up a compound angle, whether it be for milling a block, drilling a hole, or inspecting the finished product, is to label the angles  $A$  and  $B$  and three corners  $a$ ,  $b$ , and  $c$  as in Fig. 2, and then apply Formulas (1), (2), and (3) to get  $H_a$  and  $H_b$ .

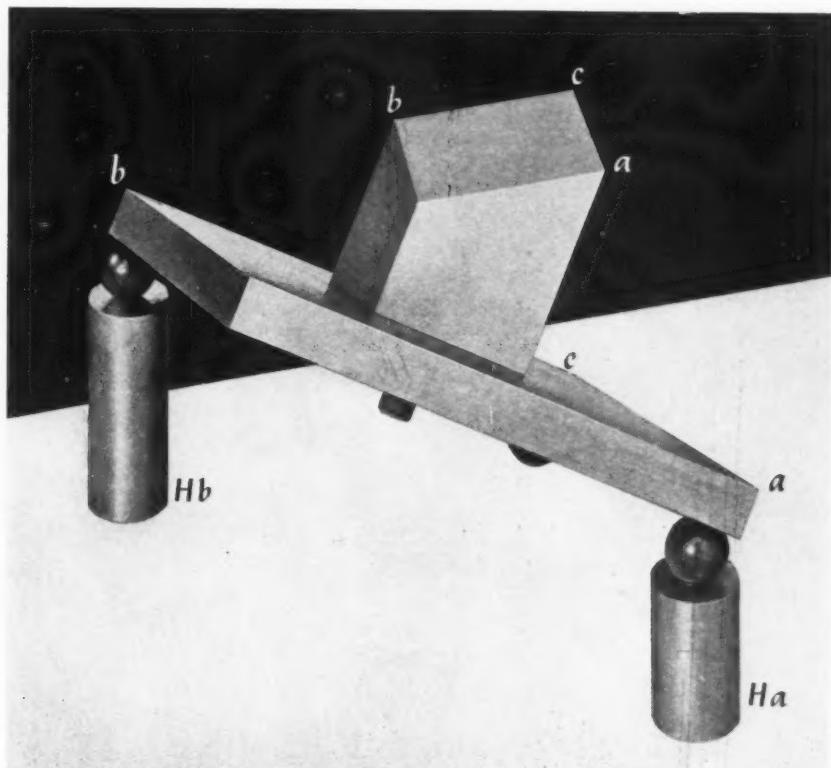
Fastening and squaring of the work to be checked, or machined, to the surface of the sine plate can be accomplished in any number of ways. It can be held by gravity against restpins  $K$ , Fig. 1, or by a screw passing through the

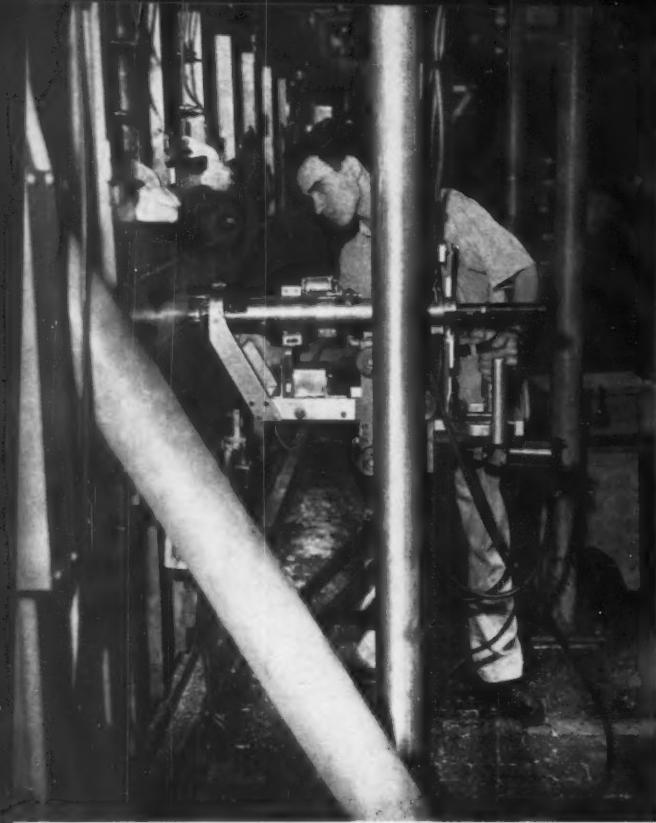


sine plate and engaging a threaded hole in the work-piece. The method of clamping the sine plate to the machine table for machining operations is left to the ingenuity of the reader.

For a method of using the sine plate in reverse—to find the angles  $A$  and  $B$  corresponding to known values of  $H_a$  and  $H_b$ —see this month's Problem Clinic.

**Fig. 3. Here, the block in Fig. 2 has been fastened to the sine plate and the plate raised by rods ( $H_a$ ) and ( $H_b$ ) to make the face of the block parallel to the surface plate.**



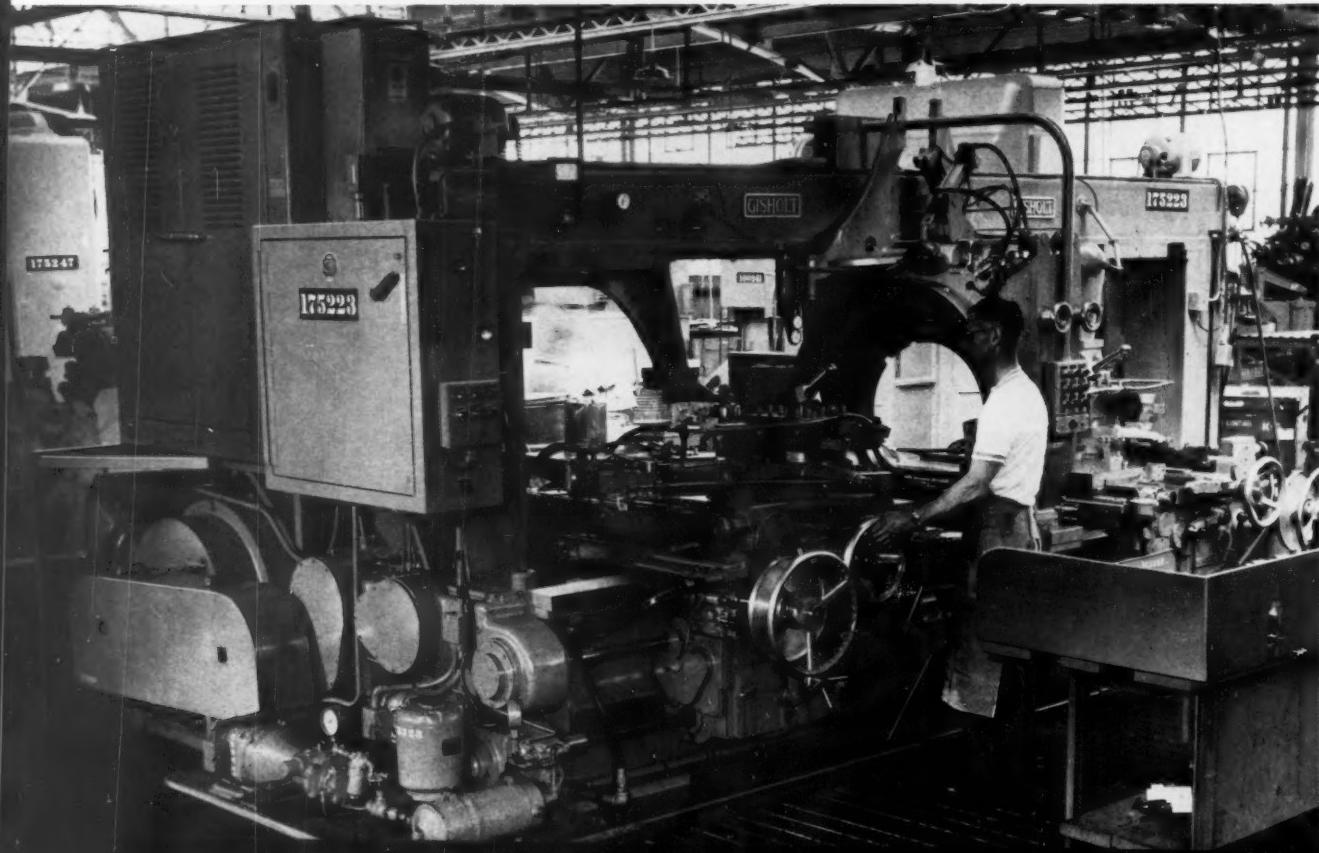


# In Shops Around the Country

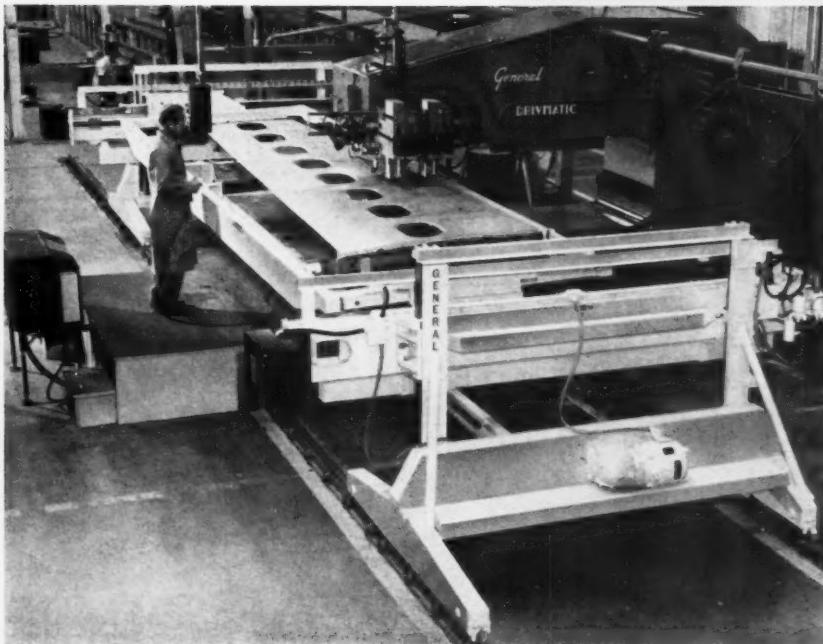
Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

A self-aligning, air-fed drill countersinks rivet holes in an aircraft skin at the Glenn L. Martin Co., Baltimore, Md. The drill fixture assures that the countersunk surfaces are perpendicular to the skin and are uniform in depth.

One of a battery of new Gisholt center-drive lathes at work at Pratt & Whitney Aircraft, East Hartford, Conn. The tracer-controlled equipment simultaneously machines both sides of discs for jet-engine compressors and turbines, assuring flatness and accuracy by balancing cutting pressures.

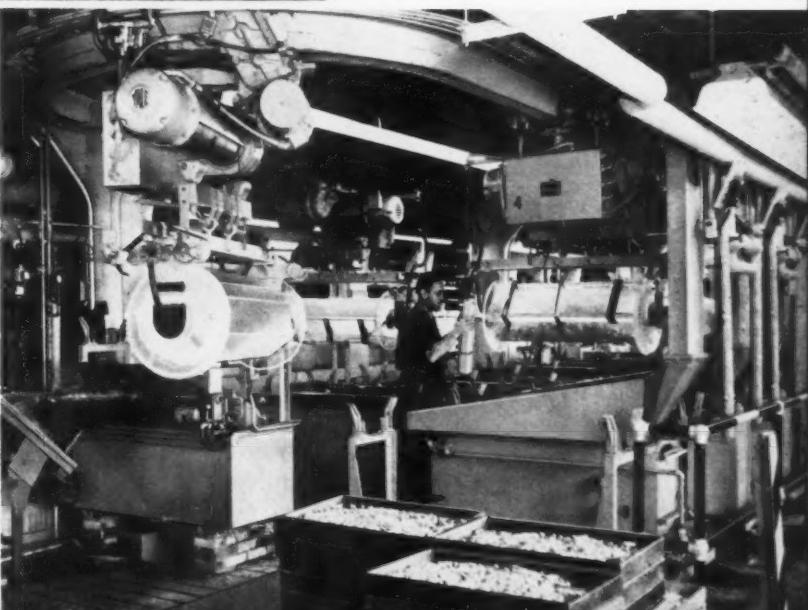


Covers and shells of refrigerator compressors are arc-welded in a carbon-dioxide shield at American Motors' Kelvinator division, Detroit, Mich. The compressors rotate 360 degrees in front of the arc, then are ejected onto a chute.



Fuel-tight slug rivets are automatically driven in a wing-section at Northrop Aircraft, Hawthorne, Calif. Opaque punched tapes at the ends of the riveter, a General Drivematic, allow a light to actuate electronic eyes to guide the machine transversely. Another tape, behind the operator, controls longitudinal motion and the hole-forming tools.

Plating razor parts at the Gillette Razor Co., Boston, Mass. Processing tanks are arranged in an oval, with six Yale electric hoists having motor-driven trolleys mounted on a loop over the tanks. Parts are contained in perforated, plastic barrels suspended from hoists and rotate automatically when in each tank.





## MACHINERY'S PROBLEM CLINIC

**Mathematical problems in shop work and tool design submitted by readers of MACHINERY**

Edited by HENRY H. RYFFEL

### Three-Ball Sine Plate Used in Reverse

The sine-plate article in this issue shows how to set the plate when the angles  $A$  and  $B$  are known. The reverse problem is to find the unknown angles  $A$  and  $B$  when  $H_a$  and  $H_b$  are given. A typical application of this procedure would be in finding the angles to enable duplicating an unknown part.

*Solution:*

The three equations given in the article are:

$$\tan C = \tan A \cos B \quad (1)$$

$$H_a = 5 \sin C \quad (2)$$

$$H_b = 5 \sin B \cos C \quad (3)$$

The first step is to solve Equation (2) for angle  $C$ . For example, if  $H_a = 1.5031$  and  $H_b = 2.3843$ , then from Equation (2),

$$\sin C = \frac{1.5031}{5} = 0.30062$$

$$C = 17^\circ 29' 42''$$

The next step is to solve Equation (3) for angle  $B$ :

$$\begin{aligned} \sin B &= \frac{H_b}{5 \cos C} \\ &= \frac{2.3843}{5 \times 0.95374} = 0.499989 \\ B &= 30^\circ \end{aligned}$$

The final step is to solve Equation (1) for angle  $A$ :

$$\begin{aligned} \tan A &= \frac{\tan C}{\cos B} \\ &= \frac{0.31521}{0.86603} = 0.363971 \\ A &= 20^\circ \end{aligned}$$

### Amends for November's Problem

The formula

$$S = \sqrt{(L+R)^2 - M^2} - \sqrt{(L-R)^2 - M^2}$$

given in the November clinic was used in a trial-and-error solution to get a value for  $R$ . Actually, as pointed out in a number of letters to the editor, this formula could have been rearranged to give  $R$  directly in terms of  $L$ ,  $M$ , and  $S$ .

*Solution:*

$$S = \sqrt{(L+R)^2 - M^2} - \sqrt{(L-R)^2 - M^2} \quad (1)$$

$$S + \sqrt{(L-R)^2 - M^2} = \sqrt{(L+R)^2 - M^2} \quad (2)$$

Squaring both sides of Equation (2), simplifying, and collecting terms,

$$2S\sqrt{(L-R)^2 - M^2} = 4LR - S^2 \quad (3)$$

Squaring both sides of Equation (3) and collecting terms,

$$R^2 = \frac{S^2 (4L^2 - S^2 - 4M^2)}{4 (4L^2 - S^2)} \quad (4)$$

$$= \frac{S^2}{4} \left( 1 - \frac{4M^2}{4L^2 - S^2} \right)$$

Taking the square root of both sides of Equation (4),

$$R = \frac{S}{2} \sqrt{1 - \frac{4M^2}{4L^2 - S^2}} \quad (5)$$

For  $L = 10$  inches,  $M = 1.5$  inches,  $S = 5$  inches,

$$\begin{aligned} R &= \frac{5}{2} \sqrt{1 - \frac{4(1.5)^2}{4(10)^2 - 5^2}} \\ &= 2.5 \sqrt{1 - \frac{9}{375}} \\ &= 2.5 \sqrt{1 - 0.024} = 2.5\sqrt{0.976} \\ &= 2.4698 \text{ inches} \end{aligned}$$

**Send in your interesting problem and its solution for presentation on this page**

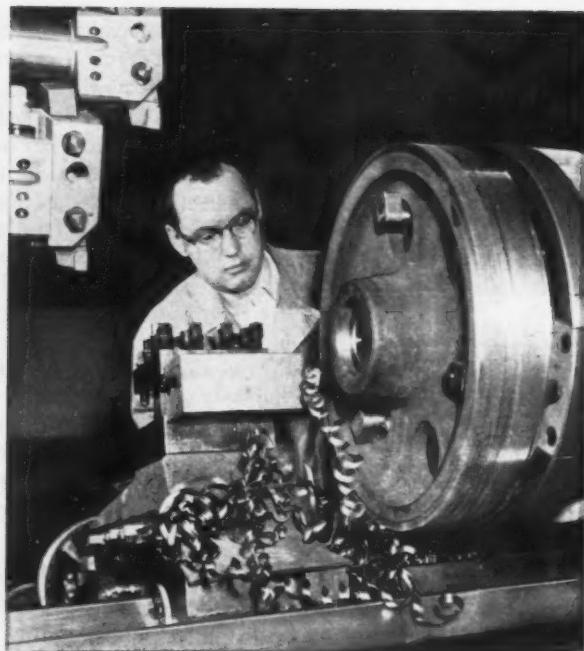
**MACHINERY'S**

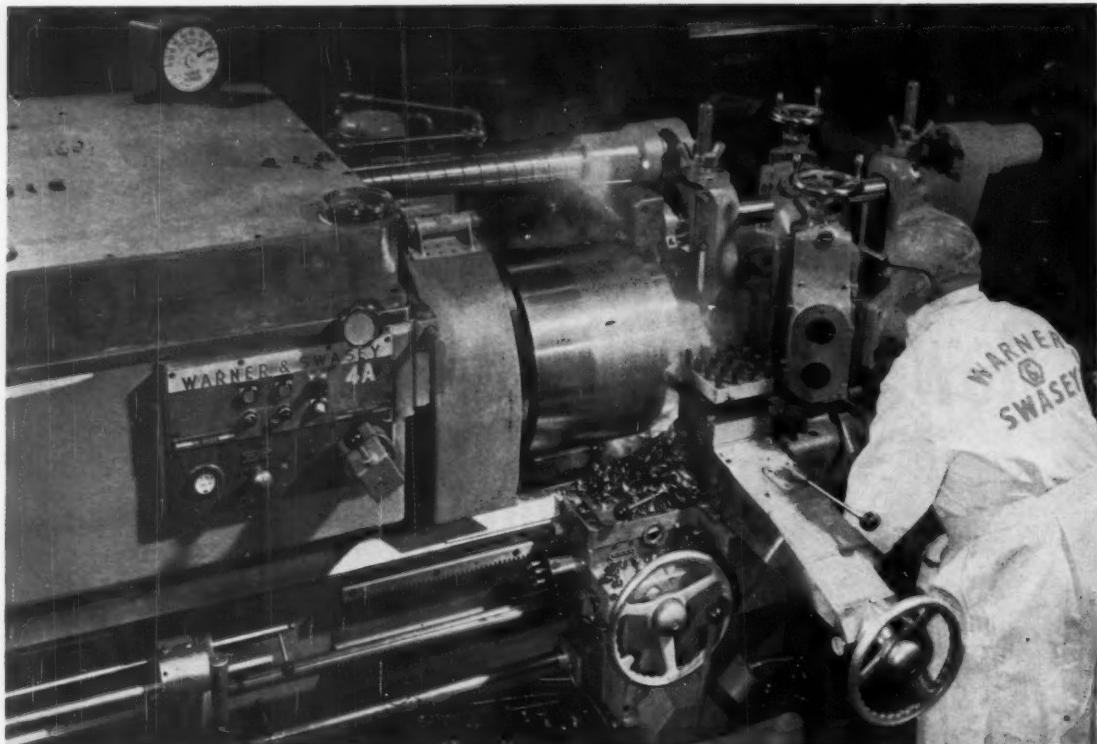
*Machine  
Reference Section*

January 1957

# How Are YOUR Carbide Tools Performing?

Part 1





# How Are YOUR Carbide Tools Performing?

**Carbide cutting tools are used in almost every metalworking shop today, and, in many instances, shortsighted performance data are taken for granted. As a result, the full measure of their capabilities is paid for but frequently not realized. There are several factors on which hinge the performance and life span of your carbide tools. Two pertinent items, chip-breakers and tool wear, are studied in this first installment.**

DURING World War II, much publicity was given to the development of advanced techniques in the use of carbide tools. Numerous unusual jobs were described, in which extremely high cutting speeds were attained under certain favorable conditions. In order to determine whether these techniques, born of the necessity for high production, would lead to a general increase in machine tool requirements, the Warner & Swasey Co., Cleveland, Ohio, decided to make a detailed study of carbide usage.

As a first step in this study, visits were made to a large number of companies in order to observe methods and to compare experiences. The main observations that resulted from this first phase of the study are as follows:

1. Under certain conditions, it appeared that the performance of carbide tools could be extended considerably beyond what was generally accepted as normal for high-speed steel tools. This, in turn, was generally thought to mean that cutting speeds should be increased by proportionate amounts.

This article is based on data contained in laboratory reports compiled by J. F. Allen who was, at the time these tests were undertaken, research engineer at the Warner & Swasey Co., Cleveland, Ohio. All data were placed in the hands of Professors Shaw, Smith, and Cook of the Machine Tool Division, Massachusetts Institute of Technology, Cambridge, Mass. After reviewing and analyzing the reports, they prepared this enlightening study on the performance of carbide cutting tools. Mr. Allen is presently factory manager at the Cameron Iron Works, Inc., Houston, Tex.



2. Negative rake angles were claimed to give superior results with carbide tools in all cases.
3. Cutting without a fluid was generally recommended for carbide tools.
4. The difficulty of obtaining an accurate evaluation of carbide tools by observations in a large number of plants under production conditions was recognized.

Each of the first three observations has proved to be only partially correct, while the fourth seems to have stood the test of time. As a result of the last observation, it was decided that a comprehensive study of carbide cutting tools should be carried out under controlled conditions. The resulting tests took many months, but brought to light a number of carbide tool characteristics which still are not appreciated by all tool engineers.

#### **Equipment and Test Conditions**

A standard Warner & Swasey turret lathe was altered for operations at very high speeds and high power levels. A direct-current motor, capable of intermittent duty at 100 H.P., was used, and the main spindle was fitted with fog-lubricated precision roller bearings. The normal top spindle speed of 1900 R.P.M. was boosted to 5500 R.P.M. by use of a geared speed increaser.

Cutting forces were measured by a Schiess-Defries three-component dynamometer modified by the use of wire resistance strain gages to convert it into a recording instrument. The tools used consisted of Type C-6 (designation of the Carbide Industry Standardization Committee) car-

bide tips silver-soldered to AISI 1050 steel shanks. Tool tips measured 3/16 by 3/8 by 7/16 inch and were ground to the standard tool angles given in the accompanying table.

Tools were first rough-ground (dry), using 60-grit followed by 80-grit silicon carbide wheels, and then finish-ground (water-base fluid), using 220-grit resinoid diamond wheels. Chip-breakers, when used, were ground into the tool face using a 320-grit resinoid diamond wheel and a water-base fluid. All the work material was hot-rolled from the same heat of AISI 1020 steel. Each bar had a Brinell hardness of 156, was 24 inches long, and, during the tests, was machined from 4 1/4 inches in diameter to a diameter of 1 1/4 inches.

Development of a wear land on the clearance face of the tool was followed with a filar microscope, tool life being arbitrarily defined in terms of a 0.030-inch wear land. The standard operating conditions, although varied in many of the tests, were as follows:

|                         |                           |
|-------------------------|---------------------------|
| Cutting speed . . . . . | 1000 feet per minute      |
| Feed . . . . .          | 0.015 inch per revolution |
| Depth of cut . . . . .  | 0.125 inch                |
| Cutting fluid . . . . . | none                      |

#### **How Carbide Tools Wear**

Progressive wearing of a carbide tool having the geometry listed in the table and being operated under the standard test conditions is shown clearly in Fig. 1. A flat area—called a wear land—develops on the clearance face, and a crater develops on the tool face across which the chip

flows. Also, a deep groove frequently develops across the cutting edge at a point corresponding to the edge of the chip farthest from the tool point. All tools considered here were removed from service when the wear land reached a value of 0.030 inch. The illustrated tool developed a wear land of this magnitude after thirteen minutes of cutting—the time being taken as the life of this particular tool.

Wear on the tool face (cratering) is actually greater than that on the clearance flank of the tool, although the presence of this crater will not cause the tool to fail until a wear land considerably in excess of 0.030 inch is reached. The deep groove previously mentioned never causes a tool to fail and should therefore be ignored.

When the tools were operated at excessive speeds, extreme temperatures were developed and the carbide actually flowed plastically as though it were a piece of soft steel. In such cases, the tool tip drooped downward and, as a result, the wear land sometimes appeared to decrease.

### Geometry of Experimental Tools

|                               |            |
|-------------------------------|------------|
| Back rake angle .....         | 0 degrees  |
| Side rake angle .....         | 6 degrees  |
| End relief angle .....        | 6 degrees  |
| Side relief angle .....       | 6 degrees  |
| End cutting-edge angle .....  | 15 degrees |
| Side cutting-edge angle ..... | 10 degrees |
| Nose radius .....             | 1/64 inch  |

Speeds at which carbide tools flow plastically are far above the practical operating range and hence this type of failure normally is not experienced in practice.

During the tests, it was found necessary to avoid running off the end of the bar as at I in Fig. 1. When this precaution was not taken, large pieces were pulled from the cutting edge as the elastic energy stored in the tool was suddenly released, and the chip catapulted from the carbide

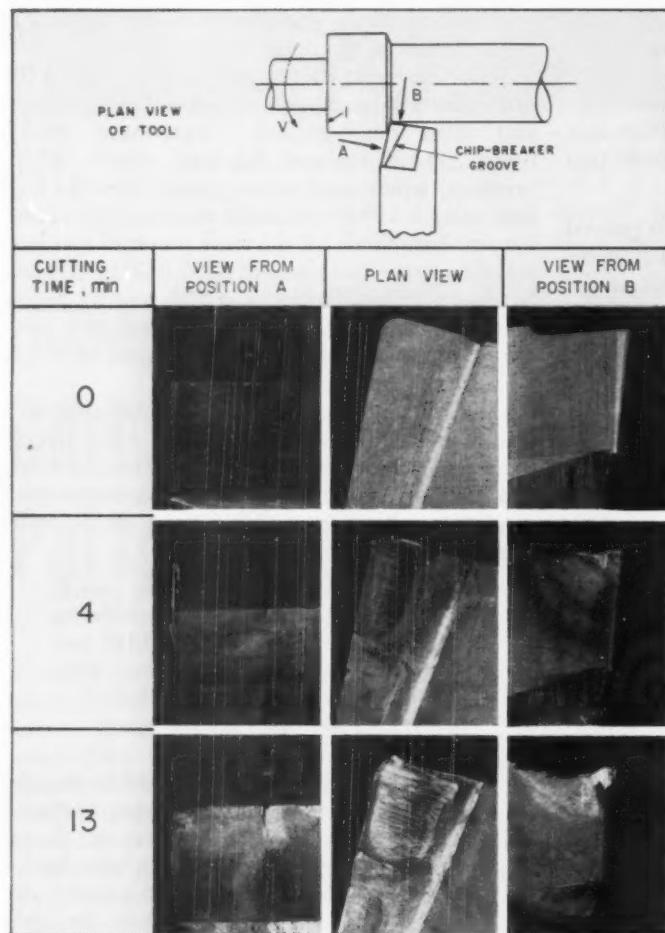
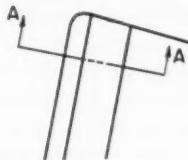
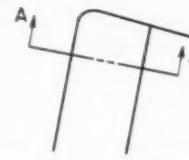
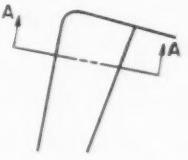
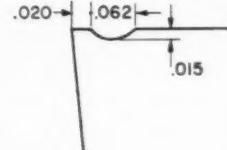
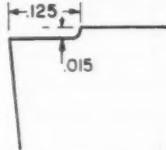
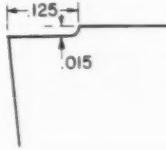
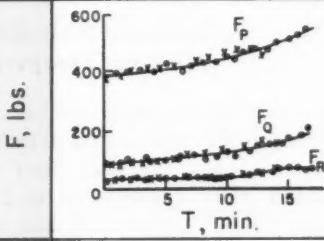
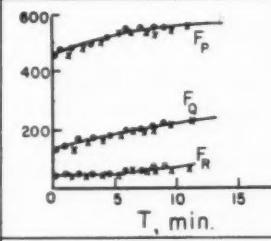
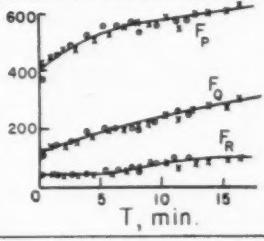
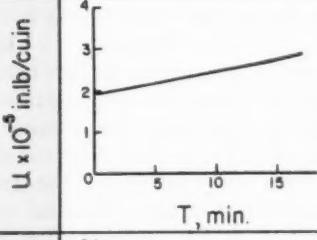
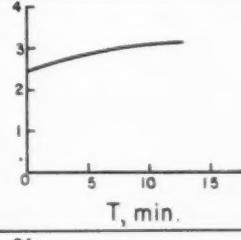
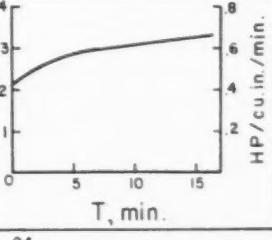
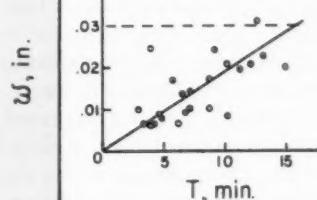
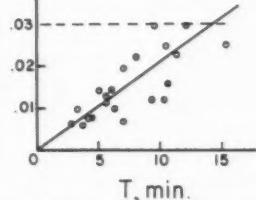
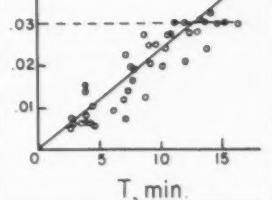


Fig. 1. Progressive stages of wear on a carbide tool after four, and again after thirteen, minutes of high-speed turning as viewed from the three positions denoted at the top.

Fig. 2. Three types of chip-breakers (top) were tested to determine their effect on cutting forces and rate of tool wear. Cutting conditions were the same in all cases, and the tool geometry appears in Table 1.

|                           | TYPE OF CHIP BREAKER  |   |   |
|---------------------------|---|---|---|
|                           | LAND & GROOVE   | PARALLEL STEP   | INCLINED STEP   |
| PLAN VIEW                 |    |    |    |
| SECTION A-A               |    |    |    |
| FORCES                    |   |   |   |
| NUMBER OF FORCE TESTS     | 2   | 2   | 2   |
| SPECIFIC ENERGY           |  |  |  |
| WEAR                      |  |  |  |
| NUMBER OF TOOL LIFE TESTS | 8   | 9   | 10  |

tip. In some instances, tools were found to fail at the bond because of residual brazing stresses and stresses due to differential expansion of carbide and shank resulting from the heat of cutting. Considerable care had to be exercised in brazing tools that were to be subjected to high cutting forces and high rates of speed.

#### *Influence of Chip-Breakers on Cutting Forces and Tool Wear*

A series of tests were made with tools having three different types of chip-breakers in order to compare the cutting forces obtained with each as well as to observe the influence on tool life. The results of this study are shown in Fig. 2, where

$F_p$  = power component of force measured in a tangential direction, pounds;

$F_q$  = feed component of force measured in a direction parallel to the work-piece axis, pounds;

$F_r$  = radial component of force measured in the direction of the tool shank, pounds.

From Fig. 2 it is evident that

1. The cutting forces vary in the same general way as the cutting time.
2. The land and groove type of chip-breaker requires about 25 per cent less power than the other two types.
3. There is no significant difference in the mean tool life for the three types of chip-breakers.

The specific energy values shown in Fig. 2 represent the work required to remove a cubic inch of metal in the form of chips, and are computed as follows:

$$u = \frac{F_p V}{Vbt} \quad (1)$$

where  $u$  = specific energy in inch-pounds per cubic inch;

$V$  = cutting speed in feet per minute;

$b$  = depth of cut in inches;

$t$  = feed in inches per revolution.

Specific horsepower is a related quantity that is computed as follows:

$$K = \frac{F_p V}{33,000 (12) Vbt} \quad (2)$$

where  $K$  = specific horsepower in horsepower per cubic inch per minute.

Hence:

$$K = \frac{u}{396,000} \quad (3)$$

Thus, the two quantities differ only by a constant and both may be represented by the same curve as illustrated.

The considerable scatter in the wear data is probably due to variations in work material and slight variations in tool geometry, as well as variations in the carbide tool material itself. From eight to ten different tools were used in getting the information to plot each wear curve.

The fact that there is a significant difference in the specific energy values and cutting force values although no significant difference in tool life for the various chip-breakers shows that, in general, cutting forces cannot be relied upon to predict differences in the life span of a tool. While the rate of crater development is strongly dependent on tool temperature, which, in turn, depends directly upon specific energy, development of the wear land depends on other quantities as well. Thus, while we might sometimes find a correlation between *total tool destruction* and specific energy (particularly when total destruction is crater induced) no such correlation need exist between specific energy and tool life defined in terms of a 0.030-inch wear land.

#### *Influence of Chip-Breaking on Cutting Temperature*

Results from a large number of tests indicated that as chips were caused to curl more tightly by use of a chip-breaker, their temperature increased. This is illustrated in Fig. 3, where the chips yielded by several land and groove type chip-breakers of different proportions are shown. All of these tests were performed at the same speed without use of a cutting fluid. It is clearly seen that as the chip-breaker becomes larger and less abrupt, the tendency for chips to break decreases. At the same time, the temper colors of the chips indicate lower temperatures.

The greater chip temperature observed when a chip-breaker is used does not necessarily mean that the temperature of the tool flank is also greater. Most of the additional energy associated in cutting with a chip-breaker is probably used in deflecting the chip, and this energy is dissipated at a point some distance from the tool flank. Thus, the greater chip temperature need not lead to an increase in tool flank wear.

It is possible that the increased temperature accompanying the use of a chip-breaker actually plays an important role in the chip-breaking process. The increased cutting forces associated with the use of a chip-breaker should give rise to higher chip temperatures and temperature gradients across the chip which, in turn, may cause in-

Fig. 3. Land and groove type chip-breakers of various proportions were tested under identical operating conditions. Types of chips and chip colors (temper colors) are shown in the last two columns.

| Condition | Chip-Breaker Dimensions, Inch |       |       | Chip Characteristics |      |
|-----------|-------------------------------|-------|-------|----------------------|------|
|           | a                             | b     | c     | Color                | Size |
| 1         | 0.010                         | 0.050 | 0.003 | Deep Blue            |      |
| 2         | 0.010                         | 0.080 | 0.006 | Medium Straw         |      |
| 3         | 0.010                         | 0.080 | 0.010 | Light Straw          |      |
| 4         | 0.010                         | 0.100 | 0.010 | Very Light Straw     |      |
| 5         | 0.010                         | 0.100 | 0.015 | Very Light Straw     |      |
| 6         | 0.015                         | 0.080 | 0.010 | Light Straw          |      |

creased chip curl. As the chip curls more it will be broken into smaller pieces when it strikes the flank of the tool. It would thus appear that the chip-breaker need not be the sole direct source of increased chip curvature, but that the additional temperature gradients across the chip may also play an important role.

Chip-breakers are not the only elements affecting the performance of cutting tools. Other important factors include tool shape and cutting conditions (speed, feed, and depth of cut). These additional variables will be studied in detail in the second and concluding installment of this article to appear in March MACHINERY.

#### **Conclusions Based on Results of the Extensive High-Speed Turning Tests Presented to Show Effect of Chip-Breakers on the Life of Carbide Tools**

1. The use of a ground chip-breaker to control chip size is associated with a rise of energy consumed and, therefore, of heat generated.
2. Different chip-breaker designs give rise to different amounts of additional force.
3. The chip-breaker design causing the lowest increase in cutting force while satisfactorily breaking chips should be the most desirable. This would appear to be the case despite the fact that little difference in the 0.030-inch wear land tool life was observed for the different chip-breakers investigated.
4. A decrease in cutting force should be accompanied by a decrease in tool face temperature and these, in turn, should give rise to an extended tool life, as measured by total destruction. Thus, when chip control is carried out with minimum rise of cutting force, a greater factor of safety against tool breakage should follow.
5. A metal-cutting dynamometer appears to offer a convenient basis of selection for the design of a chip-breaker that will provide the most satisfactory chip control.

# Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

## Bendable Tubing that Can Be Cut with Hacksaw or Knife

A line of bendable tubing that serves as electrical conduit and can easily be buried in concrete, ceiling, and floors is being made by the Flexhaust Co., Division of Callahan Zinc-Lead Co., Inc., 100 Park Ave., New York 17, N. Y. This tubing is available in three types: Plica Type A, Plica Type B, and Plica Type C. It can be cut with a hacksaw or knife, bent by hand, and fitted to all standard connectors. The tubing has a three-ply wall and can be made in almost any desired combination of ferrous and non-ferrous metals, fiber, paper, and other materials. The tubing is made on fully automatic machines in continuous lengths. It has high wall strength, is watertight, and may be bent to a sharp radius.

Type A tubing is all metal (lacquer- or lead-coated steel) and is liquid-tight up to 560 degrees F. and 60 pounds per square inch pressure. Type B is composed of two metals (lacquer- or lead-coated steel) and one paper. This type is generally used for the electrical and mechanical protection of pipes. Type C contains one metal (lacquer- or lead-coated steel) and two papers. It is used for the transmission of air and fumes. The sizes of this tubing range from 3/8 inch to 2

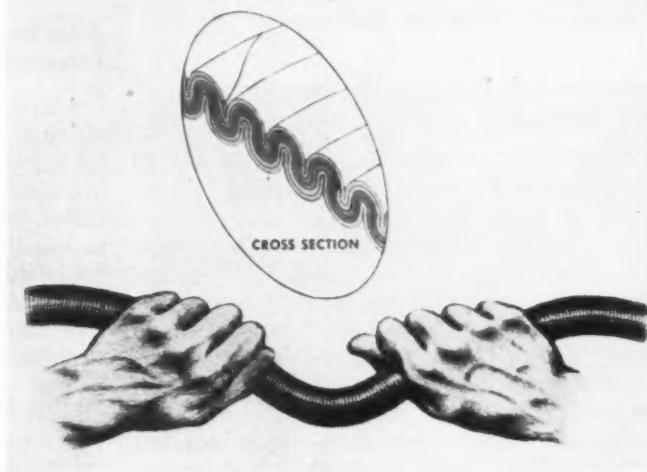
inches. Wall thicknesses range from about 1/16 inch up to almost 1/8 inch. The Flexhaust Co. will make up Plica tubing in many combinations of materials such as stainless steel, zinc-coated steel, brass, aluminum, copper, asbestos fabric, and neoprene for special applications.

## Precision Ground Flat Stock Available in Two Steel Types

Availability of Milford precision ground flat stock in a wide range of standard sizes has been announced by the Henry G. Thompson & Son Co., New Haven, Conn. The stock, which comes in a fine velvet finish, does not require finish-grinding. The flat surfaces are parallel and straight, and the edges are ground parallel and square to the ends.

This ground flat stock is available in two types of steel, oil hardening—a general purpose electric furnace non-deforming tool steel—and air hardening—recommended wherever extra resistance to wear is required. Both types maintain dimensional accuracy throughout heat-treatment. The fine grain structure, which results from heat-treatment, makes for maximum toughness with a high hardness. The stock is supplied in a fully spheroidized, annealed condition for easy ma-

Plica tubing is an easily bendable, three-layer material that can be used to carry liquids, to protect pipes and other material, and to serve as electrical conduit.



ching. Hardnesses obtainable range up to 65 Rockwell C. The materials are available in maximum lengths of 36 inches.

#### Rust Preventive that Can Be Diluted with Water

A multi-purpose rust preventive which can be mixed with water, oil, or solvent, or used straight, has been announced by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. "Rust Veto M.P." as it is called, when diluted with water makes a safe, nontoxic, nonflammable solution. It is used for the protection of metal parts and products that are to be stored indoors.

#### Build-Up Material for Use Under Hard-Facing

A foundation material for building up carbon-steel parts prior to hard-facing has been made available by All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y. Called "Roll Matrix," it is available in electrode form. The material is alloyed to resist plastic deformation, upset, and overroll under the severest working conditions. It is effective in eliminating spalling of expensive overlay alloys. Arc-welding deposits exhibit a hardness of 30 Rockwell C and cannot be machined or forged unless preheated to 400 degrees F. or red heat, respectively.

The electrode is made for application as the first step in building up carbon-steel parts which have become excessively worn. Deposits from the electrode are intended to be overlaid with a harder alloy.

Steels containing 0.35 per cent to 0.90 per cent carbon, including those alloyed with chromium nickel, molybdenum, etc., can be rebuilt. It is customary to rebuild to a point where not more than 1/4 inch thickness of hard-facing material is required. Roll Matrix is available in 1/8-, 5/32-, 3/16-, and 1/4-inch core diameters.

#### Conveyor Belt Designed for Handling Hot Materials

Metal heated to temperatures as high as 1400 degrees F. can be conveyed on a rubber belt designed for handling hot materials, according to B. F. Goodrich Industrial Products Co., Akron, Ohio. These conveyor belts, called "Fire Curtain" belts, have two plies of glass fabric that "float" in the top rubber cover. The glass fabric retains its strength despite intense heat, thus barring the progress of fiery metal objects through the belt. When a hot piece of metal drops on the belt, the rubber cover chars at that spot, but only as far down as the glass fabric heat barrier.

Hot metal cannot penetrate the barrier, and belt strength is not impaired. These belts were developed for use in foundries where burn holes are the major cause of belt failure but are now also being used in other industries employing conveyor belts for hot material.

#### Protective Films for Non-Ferrous Metals that are Easily Applied

A group of protective films called "Kenvert Chrome Sealer Type Films" designed to protect such common non-ferrous metals as copper, zinc, brass, cadmium, and aluminum against tarnish, stains, and fingerprints has been announced by the Conversion Chemical Corporation, Rockville, Conn.

These films are particularly recommended for use where the paint or lacquer film has been giving premature failure in the presence of moisture. Many of the finishes brighten as well as protect. All finishes are produced in simple, short dipping operations requiring no expensive equipment, racking, exhausting, or heating facilities.

#### Open Gear Spray Lubricant with High Adhesive Qualities

An open gear spray lubricant possessing high adhesive qualities has been announced by the Rothlan Corporation, 3618 Laclede Ave., St. Louis, Mo. Designated "Marla Spray Lubricant," this lubricant is available in 12-ounce aerosol spray containers. It is an extreme-pressure lubricant that is economical and easy to apply. A 12-ounce can covers approximately 25 square feet of surface. The lubricant facilitates the working of gears under heavy loads and provides a minimum but effective lubricating film thickness. It is also used for cams, reciprocating actions, lathe beds, guides, chains, sprockets, and cables.

#### Adhesive Suitable for Rubber, Vinyl, and Polyurethane Foams

A universal adhesive suitable for rubber, polyurethane, and vinyl foams has been announced by Anchor Adhesives Corporation, 36-23 164th St., Flushing, N. Y. "No. 292 Polyseam," as it is called, produces seams which lose all depression tack within twelve to twenty-four hours. Seams made with this material do not harden with age but remain as soft as the foam itself. The adhesive leaves a clear film, and the final bond is stronger than the foam itself. Pieces of foam may be put together three minutes after cementing or left an hour before joining, if necessary. With Polyseam, it is also possible to join foam to wood, hardboard, steel, and aluminum.

# Ceramic Tooling Tests at Kearney & Trecker

Proper holding of tips, adequate rigidity of the work-piece and machine, freedom from excessive vibration, sufficient machine power, and high speeds are essential requirements when working with ceramic tools. Better results have been obtained in turning than in milling operations, and ceramic tools have been found particularly effective for cutting special alloy cast irons. Abstract of a paper presented before the recent annual meeting of the American Society of Mechanical Engineers.

By A. O. SCHMIDT, W. I. PHILLIPS, and C. F. WILSON  
Kearney & Trecker Corporation, Milwaukee, Wis.,  
and I. HAM, University of Wisconsin, Madison, Wis.

**E**ITHER at present or in the near future many metalworking shops must consider production applications of ceramic cutting tool materials. For a long time, ceramics for this purpose have been tested in the laboratory and some have already found successful application in production setups. These materials have been greatly improved within the past year. As with every new development, there are, at the start, a number of obstacles to overcome.

Ceramics are not a cure-all. Excessive vibration in a machine tool, looseness in the slides, and deflection in the work-piece and tool are likely to cause immediate failure in ceramic tool tips. Un-

dition, will usually do a good job with ceramics.

Operators and foremen in the shop must be briefed thoroughly about the possibilities and limitations of ceramics, as well as the requirements of chip guards. Initially, it is advisable to confine tests to a single machine tool and to try to machine those aluminum, plastic, cast-iron, and steel work-pieces which, because of abrasiveness, entail excessive wear on carbide tools. A job which is tooled up completely with carbide tools and gives optimum results will usually not be improved simply by converting to ceramic tools. On such jobs carbide tools may even prove to be superior to ceramics.

Difficult, interrupted cuts with attendant mechanical shocks (which certain carbide tools can withstand) may cause more brittle ceramic tools to fail. However, even rough forgings and castings have been successfully turned with ceramic tooling after a certain amount of experience has

Table 1. Materials Used for Preliminary Ceramic Tool Life and Wear Tests

| Material        | Brinell Hardness | Test-Bar Dimensions, Inches |        |      |
|-----------------|------------------|-----------------------------|--------|------|
|                 |                  | Diameter                    | Length | Bore |
| AISI 1045 steel | 200              | 5.25                        | 31     | ..   |
| AISI 4150 steel | 190              | 5.82                        | 12.9   | ..   |
| B-45 cast iron  | 190-210          | 6.50                        | 30     | 3.0  |

der the same conditions, a strong grade of carbide can perform quite satisfactorily.

With an increase in cutting speed there is an increase in volume of metal removed per unit time, and a corresponding increase in power required. Since ceramics usually cut between two to three times as fast as carbides, the required power will be higher in the same proportion. However, a machine designed and powered for use with carbide tools, and in good working con-

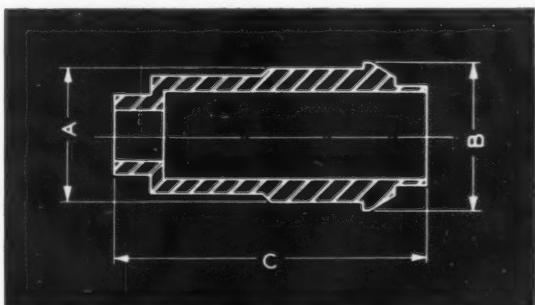


Fig. 1. Elevating-screw drive sleeve made from hot-rolled AISI 4150 steel, round bar stock. Diameter (A) is 5 inches; (B), 5 5/8 inches; and length (C), 12 9/16 inches.

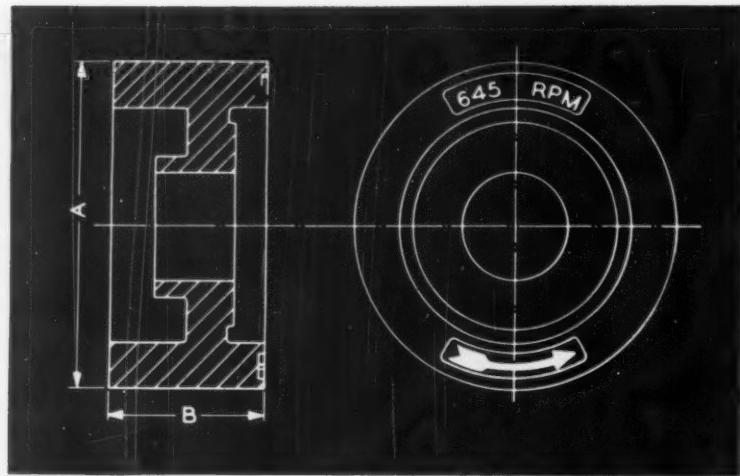


Fig. 2. Interrupted cuts were taken with ceramic tools on driver pulley face showing direction and speed of rotation. Diameter (A) is 10 inches and width (B), 4 1/2 inches.

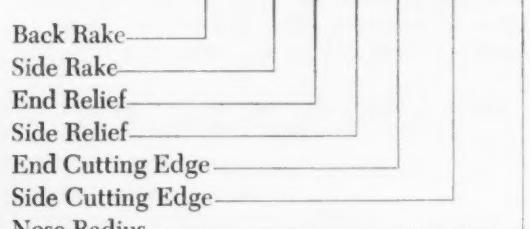
been acquired. The ceramic tools used in these tests were of an aluminum oxide type, having high resistance to mechanical impact and thermal shock, along with high hardness and inertness to chemical attack at the temperatures encountered in metal cutting. Ability to withstand very abrasive conditions will be one of the major assets in the application of ceramics as tools.

The alumina ceramics on the market today usually contain between 80 and 95 per cent aluminum oxide. Most of the alumina is combined in crystal form, and some of it becomes part of the glass film required for good inter-crystalline growth and vitrification. Ceramics are appreciably harder than carbides at higher temperatures.

Preliminary tool life and wear tests were made with the work-pieces listed in Table 1. Two examples of the several types of work-pieces tested

are an elevating-screw drive sleeve, Fig. 1, made of hot-rolled round bar stock (AISI 4150 steel) requiring heavy roughing cuts; and a driver pulley, Fig. 2. The pulley is a high-strength iron casting with irregular surfaces necessitating interrupted cuts on both sides.

Although several of the various makes and grades of ceramic tool tip materials available were tested, this report is concerned primarily with one type having a 3/16 inch thickness in two forms: hexagonal tips measuring 1/2 inch across flats, and 3/4-inch square tips. The hexagonal inserts were used for turning, and the square bits for facing and rough-turning. Both tips required special tool-holders. The tool signature for the hexagonal tool is: -2, -2, 3, 3, 3, 45, 1/16



For the square tool, the signature is: -5, -5, 3, 6, 15, 15, 1/16.

Physical and mechanical properties of the ceramic tool material used in these tests were:

|   |                  |
|---|------------------|
| Specific Gravity .....                              | 3.85-3.99        |
| Hardness, Rockwell A .....                          | 91-95            |
| Compressive strength, pounds per square inch .....  | 400,000          |
| Modulus of elasticity, pounds per square inch ..... | $45 \times 10^6$ |

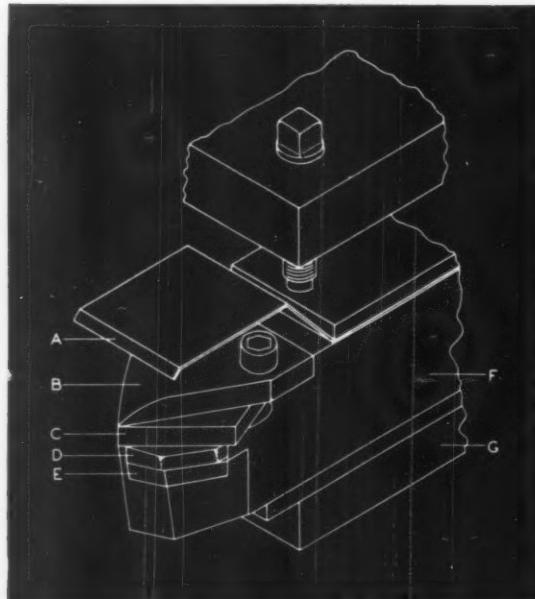


Fig. 3. Special tool-holder has chip shield (A) for turning cast iron with ceramics. Other parts are clamp (B), carbide chip-breaker (C), ceramic tip (D), support pad (E), tool-holder shank (F), and toolpost (G).

Sintered carbide tools recommended and used in Kearney & Trecker shops for machining steel and cast iron were tested concurrently with the ceramic tools for purposes of comparison. The tool signature for both the steel-cutting grade and the cast-iron-cutting grade carbide tools was 0, 7, 7, 7, 14, 0, 1/32. For most of the tests, a 15-H.P., 22-inch Monarch engine lathe was used. Several machines in production departments were also included in application test runs.

Frequent observations and measurements of the wear land during cutting operations were made with a Brinell microscope. Terminal wear measurements were taken with a toolmaker's microscope ( $50\times$ ). Photomicrographs of wear failure and breakage of tool tips were taken with special microscopes and attachments.

As the cutting speed was increased, control of fast-moving chips ejected during the cutting operation became more difficult. Carbide chip-breakers, as furnished with the tools, were used in turning steel. In cast-iron machining operations, a shield above the tool tip, Fig. 3, was provided to protect the operator from flying chips.

Since the primary object of these tests was to determine optimum cutting conditions for ce-

**Table 2. Speed Ranges, Feeds, and Depths of Cuts Used in Testing**

| Speed Range,<br>Feet per Minute |            | Feed,<br>Inch<br>per<br>Revolution | Depth<br>of<br>Cut,<br>Inch |
|---------------------------------|------------|------------------------------------|-----------------------------|
| Ceramic                         | Carbide    |                                    |                             |
| 1000 to 400                     | 400 to 200 | 0.016                              | 0.160                       |
| 1000 to 400                     | 400 to 200 | 0.010                              | 0.100                       |
| 800 to 400                      | 300 to 150 | 0.010                              | 0.280                       |

ramic tool applications in a production shop, it was necessary to select some reasonable ranges of speeds both applicable to and available in present-day machine tools. Tool life tests without a cutting fluid under the conditions listed below were carried out to a terminal flank wear of 0.008 or 0.010 inch, in most instances. Several tests were continued to the point of destructive failure or breakage in an effort to determine the cause and nature of ceramic tool failure. Speed ranges, feeds, and depths of cut are given in Table 2.

A summary of test results is given in Table 3. As can be seen, the improvement in performance of ceramic tools in comparison with carbide tools is more pronounced at higher than at lower cut-

**Table 3. Test Results in Machining Various Materials with Ceramic and Carbide Tools**

| Code Symbol    | Work-Piece Material | Tool Material, Shape                     | Cutting Speed, Feet per Minute | Feed, Inch per Revolution | Depth of Cut, Inch | Tool Life, Minutes         | Terminal Flank Wear, Inch | Cutting Speed, Feet per Minute, for a 30-Minute Tool Life | Cutting Speed, Feet per Minute, for a 60-Minute Tool Life | Slope $n$ | Constant $C = VT^n$ |
|----------------|---------------------|--|--------------------------------|---------------------------|--------------------|----------------------------|---------------------------|---|---|-----------|---------------------|
| A              | B-45 Cast Iron      | Ceramic, Hexagonal                       | 611<br>920<br>1054             | 0.016                     | 0.160              | 58.20<br>18.54<br>13.58    | 0.010                     | 780   | 605   | 0.37      | 2700                |
| B              | AISI 4150           | Ceramic, Hexagonal                       | 550<br>690<br>850              | 0.016                     | 0.160              | 26.80<br>14.00<br>9.00     | 0.008                     | 560   | 400   | 0.40      | 2000                |
| C              | AISI 1045           | Ceramic, Hexagonal                       | 395<br>585<br>670<br>875       | 0.016                     | 0.160              | 21.0<br>10.0<br>5.5<br>2.2 | 0.010                     | 340   | 270   | 0.39      | 1300                |
| B <sub>1</sub> | AISI 4150           | Ceramic, Square                          | 445<br>865                     | 0.010                     | 0.280              | 33.00<br>3.42              | 0.008                     | 460   | 375   | 0.30      | 1260                |
| C <sub>1</sub> | AISI 1045           | Ceramic, Hexagonal                       | 410<br>770<br>1060             | 0.010                     | 0.100              | 56.28<br>19.88<br>11.60    | 0.010                     | 580   | 390   | 0.55      | 4100                |
| AA             | B-45 Cast Iron      | Carbide, Cast-Iron-Cutting Grade, Brazed | 200<br>305<br>400              | 0.016                     | 0.160              | 30.00<br>6.00<br>2.00      | 0.010                     | 200   | 170   | 0.26      | 490                 |
| BB             | AISI 4150           | Carbide, Steel-Cutting Grade             | 308<br>360<br>560              | 0.016                     | 0.160              | 33.9<br>14.0<br>1.75       | 0.010                     | 310   | 270   | 0.20      | 620                 |
| CC             | AISI 1045           | Carbide, Steel-Cutting Grade             | 325<br>385<br>625              | 0.016                     | 0.160              | 30.0<br>17.0<br>2.0        | 0.010                     | 330   | 280   | 0.24      | 760                 |

\* Constant  $C$  = the cutting speed (in feet per minute) for a tool life of one minute;  $V$  = cutting speed, feet per minute;  $T$  = the tool life or duration of cut between grindings, minutes; and  $n$  = the slope of a straight line (plotted on log-log paper) showing relationship between tool life and cutting speed.

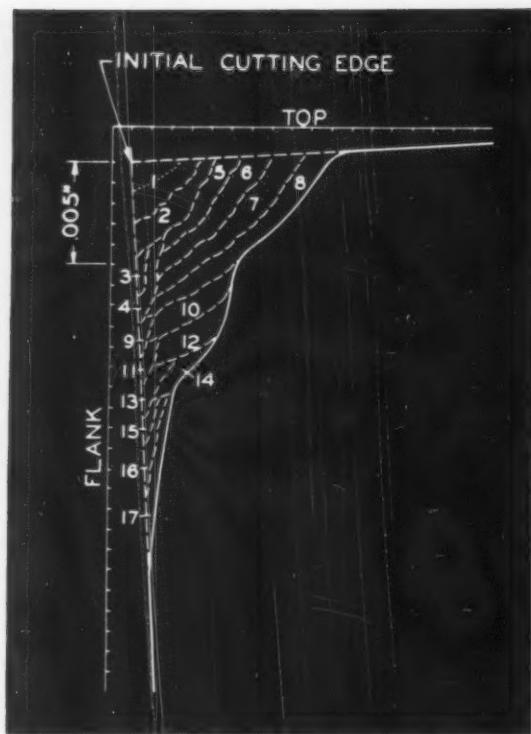


Fig. 4. Diagrammatic representation of several possible stages in the progression of wear on a typical ceramic tool tip.

pearance and nature of the wear process can be detected.

During the first few seconds or minutes of cutting, depending on the cut, only minor chipping (approximately 0.001 to 0.005 inch along the line of the cutting edge) can be observed. This chipping of the sharp edge occurs quickly and then progresses more slowly. Unless careful observations are made, it is easy to misinterpret this initial stage of wear as flank wear similar to that occurring in carbides. It has been found that honing of the sharp edge delays the initial chipping process, or extends the time over which it takes place. Honing a flat approximately 0.003 inch wide on the cutting edge is to be recommended as a means of increasing ceramic tool life.

As cutting proceeds, minor chipping begins and progresses on the flank of the tip until the total width of wear land measures approximately 0.005 to 0.010 inch. After this amount of wear has developed, the flank wear on a ceramic tip, at first sight, may appear the same as on a carbide tip. Careful observation reveals minor chipping along the cutting edge and succeeding flank wear, as seen in Fig. 4.

Under certain conditions (such as poor seating of the tip or heavy, interrupted cuts) major chipping on the top or rake surface, fracture in the middle of the tip, or complete breakdown of the nose may occur. By the time 0.010 to 0.030 inch of flank wear has been attained, it is very likely that other types of failure will have occurred, such as major chipping on the cutting edge shoulder or nose, or gross cracking or fracture. For this reason, it may not be good practice to cut with ceramic tools to a flank wear of 0.030 inch, as is quite common with carbides. It is better practice to index or regrind the tips when they have been worn on the flank to a width of about 0.010 to 0.015 inch.

Among the causes for failures and breakdowns are improper cutting conditions, tool material, tool-holder (especially carbide seat or pad), chip-breaker, and tool angles. Fracture of the tool tip sometimes occurred at the beginning of cutting because of improper carbide seats or pads. These seats must be uniformly flat and rigid to support the ceramic tip without setting up stress concentrations in the tip. Tool life was affected by tool material and structure but not by tip sizes used in these tests. A fine crystalline structure, permitting only minor chipping, seems to be best from the standpoint of tool life.

No crater wear (as observed in carbides and high-speed steel tools) could be detected on the

ting speeds. In fact, at lower speeds some grades of carbide can perform equally as well as or better than ceramic materials. At higher cutting speeds, under proper conditions, ceramic tools may remove two to four times more volume of metal than carbides in the same length of time with equal tool life in terms of cutting time.

With ceramic tools, AISI 4150 showed better machinability than AISI 1045. Microscopic examination of the AISI 1045 steel machined showed definite banding of ferrite and large pearlitic grain size, while the AISI 4150 had a uniform distribution of finer pearlitic grain size. With carbide tools, this situation was reversed. At a cutting speed of about 320 feet per minute, tool life was the same for ceramics and carbides when machining AISI 1045. At lower speeds, the carbides were superior; and at higher speeds, the ceramics gave better performance.

Special alloy cast irons used for machine tool parts have frequently been more difficult to machine with carbides than with steels. With ceramic tools, these same cast irons are more easily machined than steels, apparently because of the favorable abrasion-resistance of ceramics.

The nature of the wear process and failure in individual ceramic tool tips was observed carefully with the aid of a microscope. In a cursory examination, the appearance of flank wear on ceramic tools is similar to that on carbide tools. On closer inspection, however, a difference in ap-

ceramic tips tested. What may often appear to be cratering actually is an accumulation of metal particles lightly adhered to (but not welded to) the tool tip under the high temperatures usually associated with high cutting speeds. Wear by welding of particles of the tool material to the moving chip (of a degree experienced in crater wear of carbides) does not seem to apply as an explanation of wear process involved in machining metals with ceramics.

Since crater wear did not occur, flank wear was selected as the measure of tool life. Several patterns in the relation between flank wear and cutting time were obtained under various conditions. A nearly linear relation was observed above an initial flank wear of about 0.004 inch, as can be seen in Fig. 5. Sometimes the width of flank wear did not change during an appreciable interval of cutting time.

With carbide tools, a linear wear-time relation between approximately 0.002 to 0.015 inch width of flank wear—with much more rapid wear below and above these limits—is not uncommon. This is substantially similar to the linear relation reported here for ceramics after a rapid initial wear of about 0.004 inch has taken place.

The process involved in rapid initial tool wear merits further investigation, as does the stepwise progress of flank wear noted in some of these tests. This phenomenon, in which the width of wear land on a ceramic tool tip may not change measurably at all during an increment of several minutes of cutting time, had never been encountered with carbide tools, and was perplexing when first observed. When the flank wear does not increase during several minutes of cutting, wear is occurring in another direction, in a fash-

ion such as shown by areas 5, 6, 7, and 8 in Fig. 4. The appearance under the microscope of this type of wear on ceramic tools differs from that on carbide tools.

An important problem in the application of ceramic tools is adequate protection of the cutting edge against work-hardened chips which strike the cutting edge outside the region of cutting, thus causing major chipping and subsequent breakage. This situation can be materially improved by using a proper side-cutting-edge angle and chip-breaker especially shaped so as not to permit the chip to impinge on a part of the cutting edge which is not actually cutting. If the tip is sufficiently well protected against major chipping and breakage, ceramic tools frequently wear uniformly. Under these conditions, ceramics cut as well as any other material and often have better tool life.

When a carbide being used on a job is wearing too rapidly on the flank (or by cratering), substitution of a harder grade of carbide may be the best solution. If this harder carbide still wears away at a high rate, then ceramics should be tried if setup conditions are rigid and the power capacity of the machine is sufficient. Because of their higher hardness at elevated temperatures, ceramics may be the better tool.

Tool life in terms of volume of metal removed at various cutting speeds is shown in Figs. 6 and 7 and at various production or metal removal rates in Fig. 8. Fig. 6 also shows how the volume of AISI 4150 steel removed changes in relation to the feed and depth of cut for the same ceramic tool wear (0.008-inch flank wear). For example, at a cutting speed of 600 feet per minute, ceramic tool A produces a greater volume of chips than

**Fig. 5. Flank wear of ceramic tools in relation to cutting time at various cutting speeds, when machining AISI 4150 steel with a feed of 0.016 inch per revolution and a depth of cut of 0.160 inch.**

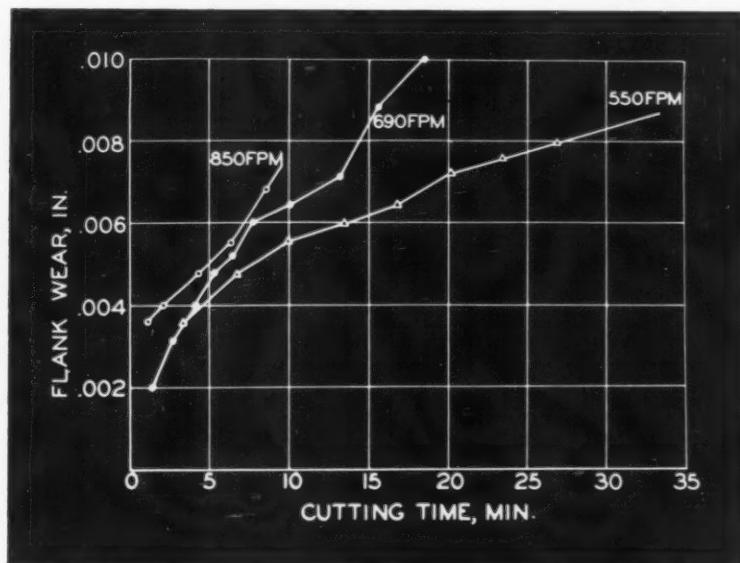


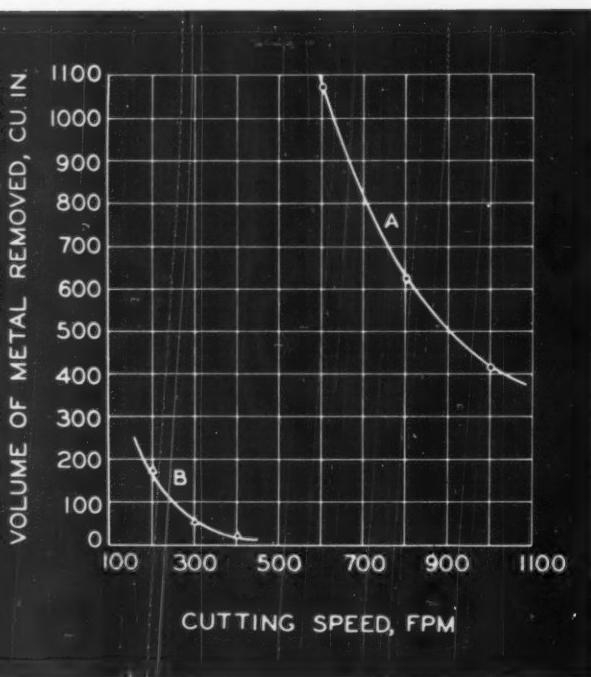
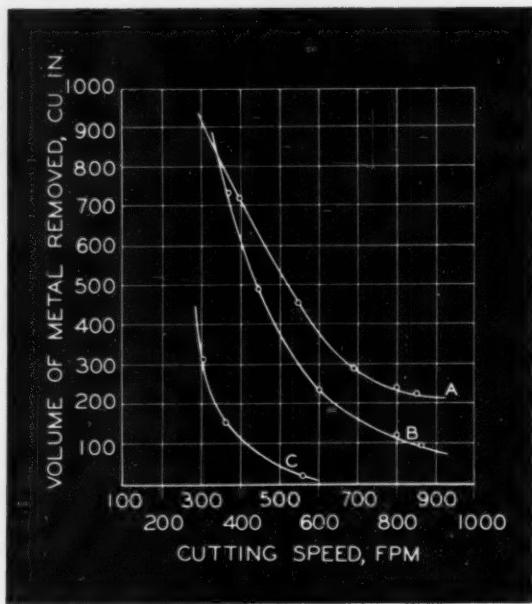
Fig. 6. Tool life (volume of metal removed) in relation to cutting speed. Tools (A) and (B) are ceramic, and (C), carbide. Both tools (A) and (C) are fed at the rate of 0.016 inch per revolution, with a depth of cut of 0.160 inch.

ceramic tool B, but at 340 feet per minute there is no difference. Tool A was fed at 0.016 inch per revolution, with a depth of cut of 0.160 inch; and tool B at a 0.010 inch per revolution, with a cut depth of 0.280 inch.

As shown in Fig. 7, under comparative cutting conditions (0.160 inch depth, 0.016 inch per revolution feed, and 0.010 inch terminal flank wear), a great increase in volume of metal removed can be obtained by using a ceramic tool A instead of a carbide tool B to machine a high-strength cast iron. For example, at 0.010-inch flank wear, a carbide tool removed a total of 25 cubic inches of metal at 400 feet per minute, while a ceramic tool cut a total of 1090 cubic inches at 600 feet per minute.

As cutting speed was increased, the rate of metal removal was increased, but at the expense of a decrease in tool life in terms of metal volume removed. Rate of metal removal is also increased as feed and depth of cut are increased, but with accompanying changes in tool life. Therefore, it is possible to select an optimum cutting speed, feed and depth of cut for a desired shop application, rate of metal removal, or tool life by studying these relationships and curves.

Tool force measurements were made with a three-component, strain-gage lathe dynamometer



using new, sharp tool tips of both ceramic and carbide having the same geometry and operating under otherwise identical conditions. Readings were taken at the beginning of the cuts to eliminate any significant change in tool geometry due to wear. Sharp ceramic tools consistently operated with approximately 5 per cent lower cutting force than the carbide tools. At the same cutting speed and metal removal rate, therefore, sharp ceramic tools require only approximately 95 per cent of the power that carbides do. However, this slight power advantage of ceramics is practically lost as tool wear progresses. Also, since ceramics operate more effectively at higher cutting speeds and rates of metal removal than do carbides, machine tools must have greater power available for machining the same work-piece with ceramics than with carbides in order to utilize the full potential of ceramics. One of the prerequisites for successful machining with ceramics is the selection of a machine tool which has performed satisfactorily with carbide tools and has a reserve power capacity adequate to cut at the increased rates of metal removal associated with ceramics. Overloading a machine can result in detrimental oscillations in cutting velocity and excessive deflections in the cutting tool assembly, work-piece, holding fixture, and machine components, all of which may, and often do, cause ceramic tool failure by gross chipping or fracture.

Calorimetric measurements of heat in the tool tip indicate that, under identical conditions, a far

Fig. 7. Much more metal is removed with ceramic tool (A) than carbide tool (B). Terminal flank wear is 0.010 inch; depth of cut, 0.160 inch; feed rate, 0.016 inch per revolution.

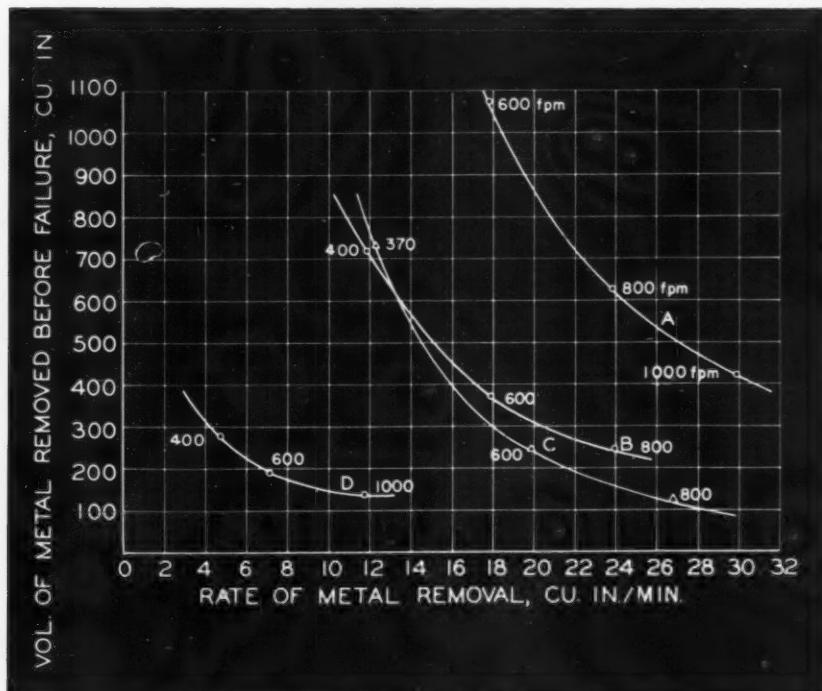
greater amount of heat accumulates in a carbide tool than in a ceramic tool tip. The tool-holder also experiences a greater temperature rise with a carbide tip than with a ceramic tip, all other conditions being equal. Materials which require more horsepower per cubic inch per minute also cause correspondingly higher heat and temperature values in either tool material.

As was the case when carbides were first used in machine shops, initial efforts of most experimenters to obtain satisfactory performance with ceramics, quite logically, have been with single-point turning tools. The testing reported here follows the same approach. After ceramic tools had worked successfully on a lathe, a two-bladed, 6-inch diameter face-milling cutter was made to hold ceramic tips with cutting angles equivalent to those prevailing in the turning tests. Unfortunately, ceramics, which had shown superiority in turning certain ferrous metals, did not perform well in milling these same materials. Primarily because of the inherent interrupted nature of cutting in milling, successful application of ceramics in milling is much more difficult than in turning. The mechanical strength of ceramic tips is usually

reduced by repeated thermal shocks such as occur in milling operations in which the tool tip, during each cutter revolution reaches a high temperature in the cut and then cools in the air. Alternating thermal and mechanical shock or impact limit the milling applications of present-day ceramics. Milling of plastics and light alloys and light finishing cuts on ferrous materials have been quite successful, since these involve reduced impact, smaller tool forces, and lower tool-tip temperatures. Milling test results with ferrous work-pieces up to now do not compare favorably with the performance of ceramics in turning. Carbides have been superior to ceramics in milling cast iron and steel.

The milling cutter for these tests was designed in such a way that regular lathe tool shanks for so-called throw-away tips could be clamped into the cutter body. The holding slots were arranged so that centrifugal force could not dislocate or release the tool-holder. As a further safety measure, a steel ring encircled the main cutter body to act as an additional restraint in retaining the tool shanks. Some of the ceramics tested were recommended for use at very high cutting speeds which made these precautions mandatory.

**Fig. 8.** Tool life expressed as volume of metal removed in relation to rate of metal removed for the following tools and cutting conditions: A—ceramic tool; terminal flank wear, 0.010 inch; material cut, high-strength cast iron; depth of cut, 0.160 inch; feed, 0.010 inch per revolution. B—ceramic tool; terminal flank wear, 0.008 inch; material cut, AISI 4150 steel; depth of cut, 0.160 inch; feed, 0.016 inch per revolution. C—ceramic tool; terminal flank wear, 0.008 inch; material cut, AISI 4150 steel; depth of cut, 0.280 inch; feed, 0.010 inch per revolution. D—carbide tool; terminal flank wear, 0.010 inch; material cut, AISI 1045 steel; depth of cut, 0.100 inch; feed 0.010 inch per revolution.



Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

## Forming Ball Bearing Races on a Lathe

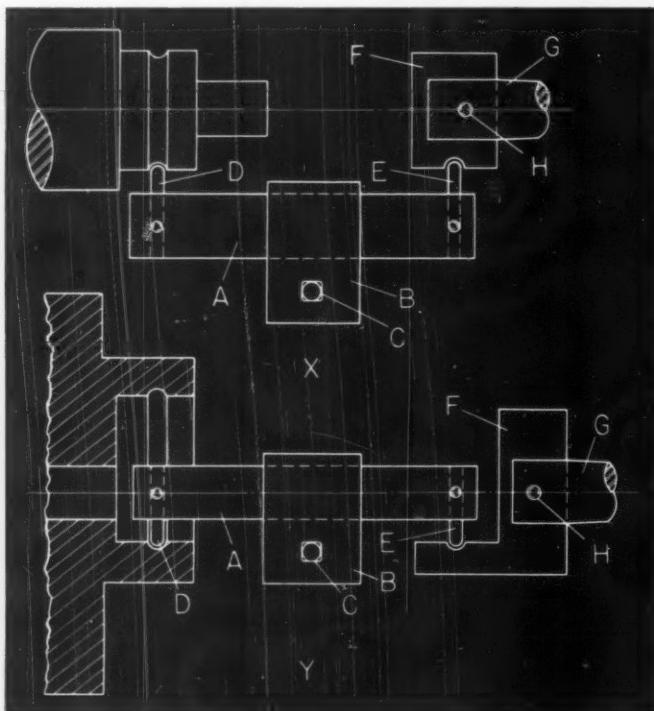
By DONALD BAKER, Boonton, N. J.

The design of radial ball bearings to be manufactured by a small job shop required that the inner and outer races be made of cold-rolled steel and left soft. These bearings mount twelve hardened balls, 1/2 inch in diameter, for which purpose a tolerance of plus or minus 0.0005 inch was specified for the diameters of the grooves in the races. Since the shop had no grinding facilities, an ingenious method was devised for lathe-forming the grooves.

The operation for machining the inner race is illustrated at X in Fig. 1. A special boring-bar A is mounted on tool-block B that is attached to the compound rest of the lathe by tool-post bolt C. The cutting tool D and a tracing stylus E are lo-

cated in opposite ends of this boring-bar. A hardened template F containing the outline of the groove for the inner race is mounted in the tailstock spindle. Tapered arbor G is slotted horizontally for this purpose and has a pin H to hold the template in position.

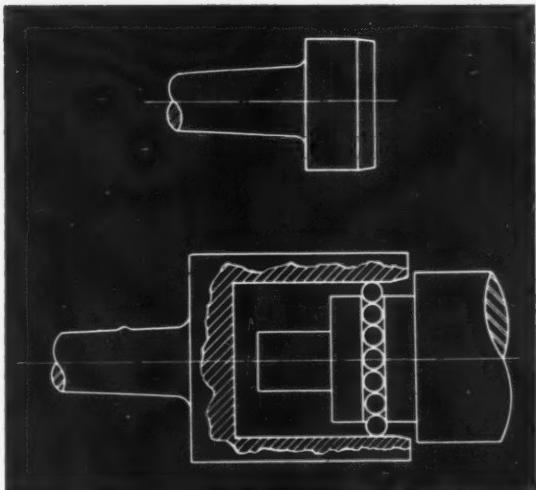
The lathe carriage is moved manually as the stylus is fed in contact with the outline in the template. The cutting tool will, of course, duplicate this movement of the stylus and produce the desired groove in the rotating work-piece. The same procedure is followed in machining the outer race of the bearing, except that the cutting tool, stylus, and template must be reversed, as shown at Y in Fig. 1.



**Fig. 1. Diagrams showing how the inner and outer races of a bearing can be formed on a lathe. The outline of the groove is machined in a template and reproduced in the work-piece by employing a tracer stylus and cutting tool.**

**Fig. 2. Tapered mandrels are used to press hardened steel balls into the grooves, thereby producing a smooth, hard surface.**

The diameters of the races are left approximately 0.004 inch over size for a finishing operation. This operation on the inner race is illustrated at the top in Fig. 2. Hardened balls, 1/2 inch in diameter, are held in the groove with heavy grease. As the work-piece rotates, a special, hardened mandrel (of the construction shown) is fed inward from the tailstock so as to press the balls into the groove. This displaces the extra metal in the groove and produces a smooth, hard surface. The internal mandrel, used for the finishing operation on the ball groove in the outer race, can be seen at the bottom of Fig. 2.



## Work-Rest for Surface Grinding Parts Seated on Angular Face

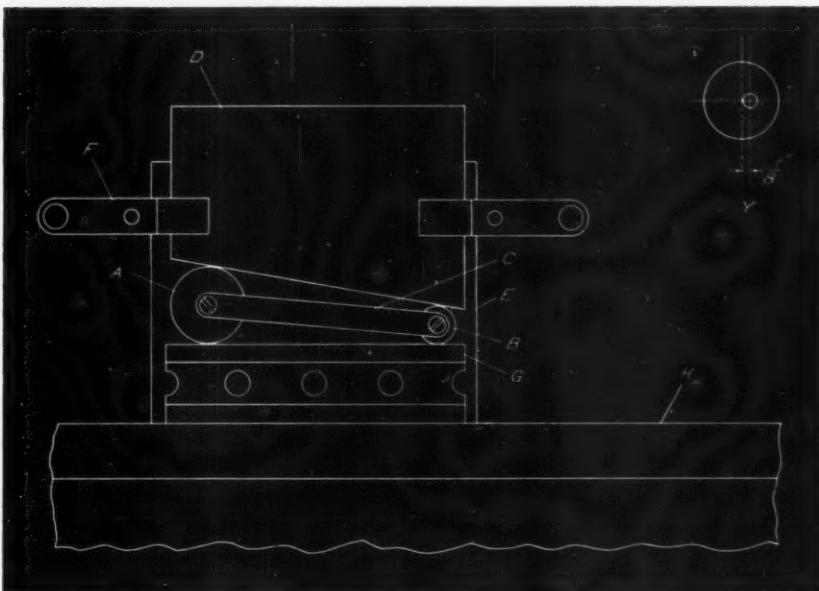
By J. RANDOLPH LUCAS, Richmond, Va.

A work-rest, useful in locating work from an angular face for the grinding of flat surfaces, is here illustrated. Basically, the unit consists of two discs A and B attached to opposite ends of bar C. Work-piece D is held on vertical face of angle-plate E by parallel clamps F. The work-rest assembly is supported by a parallel G located on the magnetic chuck H.

The center-to-center distance of the discs

should be sufficient to enable the work-piece D to be seated firmly. The discs are machined to convenient diameters, provided the difference in the diameters in combination with their center-to-center distance gives the desired angle.

To find the difference in the diameters of the two discs, determine the sine of one-half of the desired angle (using a sine table) and multiply this value by twice the center-to-center distance



**Work-rest that locates part from an angular bearing surface for surface grinding**

of the discs. The discs should differ in diameter by this amount.

Provision is made for a slight adjustment of the angle by drilling and tapping disc A 1/8 inch off

center, as indicated in view Y. The work-rest may thus be accurately set to a sine bar or a vernier bevel protractor. Once the desired angle is obtained, disc A is tightened firmly to bar C.

## Cam-Operated Chuck Featuring Self-Adjustment

A three-jaw, cam-operated chuck with self-adjusting features, made to accommodate work-pieces having variations in their outside diameters, is here shown. This chuck is being used on a special-purpose automatic lathe equipped with a magazine feed. The work-piece is a small iron casting which has to be drilled, bored, and reamed, as well as rough- and finish-faced at both the front and the rear. The rear facing operation made it impossible to use a conventional type of air or hydraulically operated chuck having a center draw-bar. The castings are loaded into the chuck by a pusher carried in the machine turret. Ejection upon completion of the operations is effected by a forward movement of the tool-spindle used in rear facing.

There are three jaws A which slide radially in guide ways in flange B having tapered sides. The flange, which is an extension of spindle H, is held by screws in body C. The jaws are moved outward by a single-coil spring D, which is anchored in one of the jaws, as shown. Each jaw is provided, at its outer end, with a tapered face which is engaged by a wedge, as at E. These wedges slide in an axial direction along studs F, which are carried by the chuck-operating sleeve G. This sleeve is keyed so that it can slide axially along the machine spindle H.

Above each wedge unit is a pressure-plate J, which is contacted by three toggle-levers K.

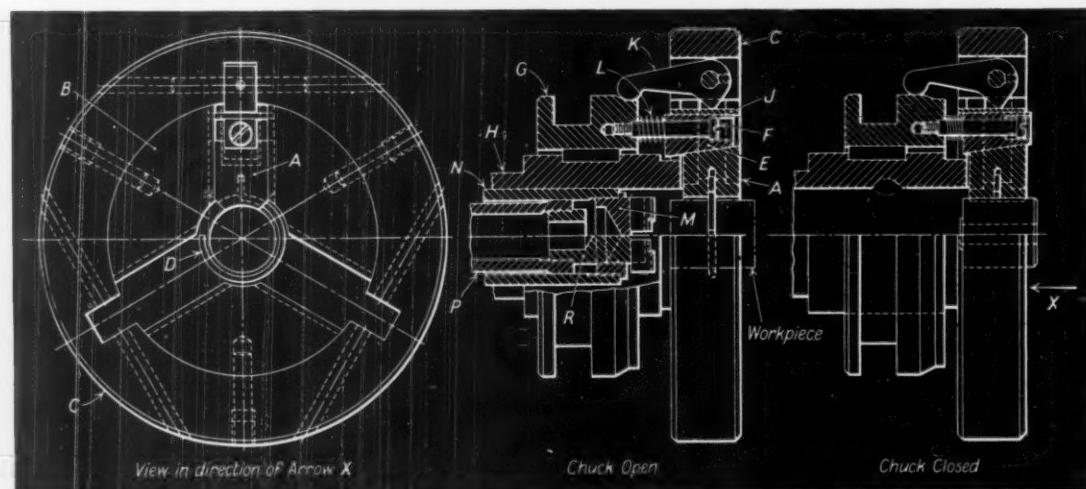
These levers are pivoted in the chuck body C, and their outer ends bear on the cam face of sleeve G, as shown. The spindle flange is cut away at three positions to provide clearance for the wedges E.

Opening and closing of the chuck are controlled by a camshaft at the front of the machine. Movement of the sleeve G to the right, to close the chuck, causes the wedges to move forward under the action of the springs L, until each jaw makes contact with the work-piece. Continued movement of the sleeve then results in the toggle-levers being actuated to lock the chuck, the heads of the studs F moving clear of the wedges, as seen in the view on the right.

The tool for rough-facing the back surface of the casting is carried in a holder M, screwed into a cam-operated sleeve N. Within this sleeve is another cam-operated sleeve P which carries the finish-facing tool-holder R. As mentioned, the finished piece is ejected by an additional forward movement of the rear facing tool.

• • •

Production efficiency and know-how of one aircraft manufacturer have reduced man-hours required in the production of a medium jet bomber to only 7 per cent of the number required for the first production model.



Self-adjusting, cam-operated chuck, designed to hold and eject work-pieces of different diameters.

# INGENIOUS

# Mechanisms

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

## Mechanism That Imparts Variable and Unequal Strokes to Opposed Reciprocating Slides

By W. M. HALLIDAY, Southport, England

Incidental to the modification of an existing machine, it was found necessary to actuate two opposed reciprocating slides. Forming tools were to be mounted on each of the slides. The drive for the mechanism had to be powered by a constant-speed shaft that also motivated other machine movements. The length of stroke of one slide had to be variable, and the stroke of each slide had to start and end at the same instant. Also, the slides were always to move in opposite

directions. The mechanism illustrated was designed to satisfy these conditions.

The two steel levers A and B, of different lengths, are mounted to pivot freely on headed studs C and D, respectively. These studs are exactly the same effective distance from the upper end of each lever. They are mounted along the same horizontal center line in machine frame E. The upper end of each lever is slotted for a short connecting link F or G. Each link pivots on a

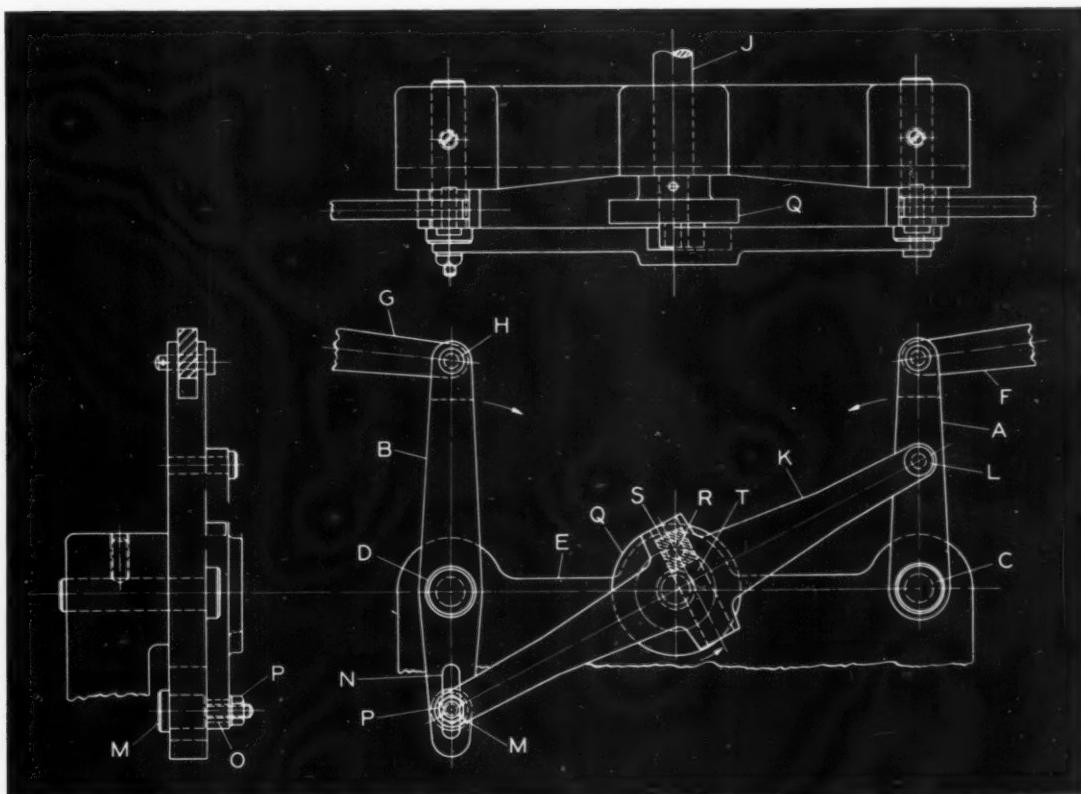


Fig. 1. Drive mechanism for opposed reciprocating slides that permits stroke adjustment of one slide.

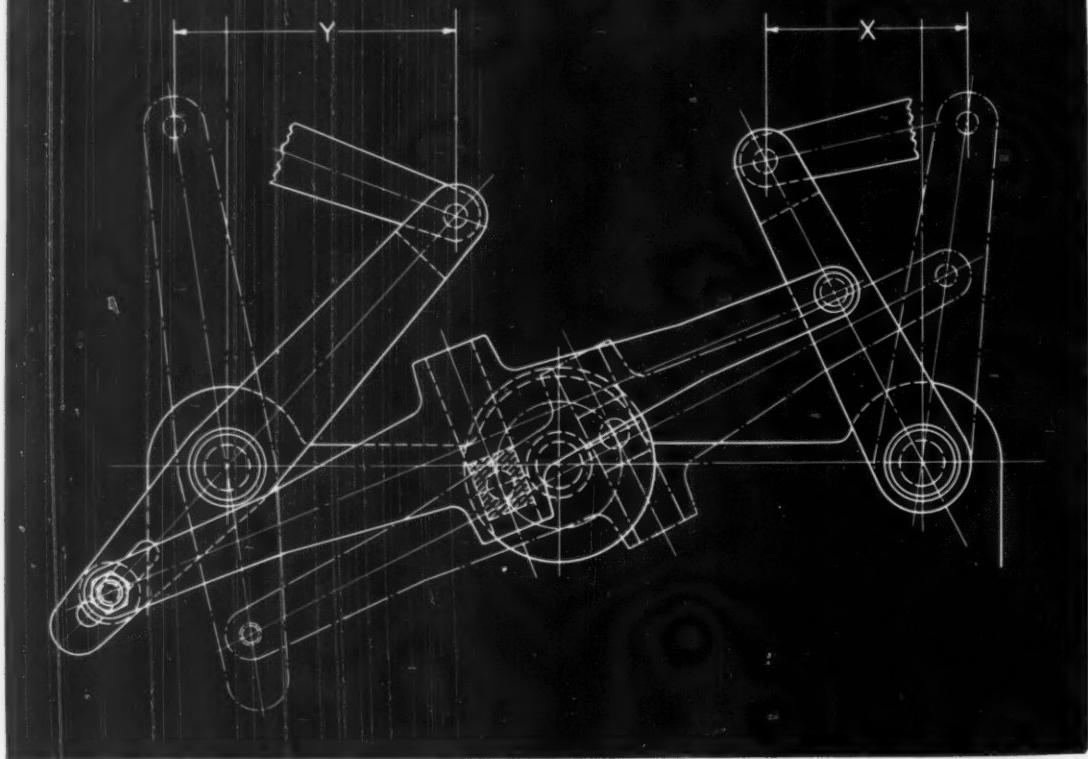


Fig. 2. Positions of drive mechanism near reversal points of the slides.

headed stud *H*. The opposite end (not shown) of each of these connecting links is coupled to a fulcrum-pin affixed in its reciprocating slide. The radial movement of the two levers is thus converted into the linear motion of the slides.

The two levers are mounted at approximately the same distance each side of the driving shaft *J* which extends from a bossed portion of the machine frame. The levers are constrained to pivot in opposite directions by means of the long steel connecting-rod *K*. The right-hand end of the connecting-rod is coupled to lever *A* by the headed stud *L* secured to the lever at a fixed center distance from the fulcrum stud *C*. The connecting-rod pivots easily on stud *L*. The left-hand end of connecting-rod *K* is attached to lever *B* so that its point of pivoting may be varied.

This connection consists of the hardened steel shoulder stud *M* which has a head of large diameter. The largest portion of the shank of this stud is flattened at two opposite sides so as to slide along the slot *N* machined in the lever *B*. On the smaller cylindrical portion of the stud projecting in front of lever *B* is mounted a hardened and ground steel sleeve *O*. This sleeve is made a smooth running fit on the stud. The outside diameter of the sleeve is similarly a close running fit within the hole of connecting-rod *K*. A nut *P* and a washer are mounted on the threaded end of stud *M*. These enable the stud and the sleeve to be locked securely to lever

*B* in any desired position along the slot. Connecting-rod *K* is thus allowed to pivot freely on the sleeve. The radial setting of stud *M*, relative to the center of stud *D*, can then be varied within the slot.

Permanently affixed to the forward end of the driving shaft is disc *Q*. The connecting-rod *K* is mounted to clear the front of this disc. The disc has a crankpin *R* set at a fixed radial distance to give the required throw to the fixed-stroke lever *A*. Rectangular brass slider member *S* is drilled and reamed to turn freely on the crankpin, and to slide easily within its guide slot *T*. This slot is formed across the inside of the wide center portion of the connecting-rod.

As the shaft and disc rotate, connecting-rod *K* will constantly alter its angular setting in relation to the levers. The levers move in unison but in opposite directions owing to the position of their connecting point to rod *K*.

In the illustration, adjustable stud *M* is set at a shorter distance from fulcrum stud *D* than the distance of stud *L* from fulcrum *C*. Thus, lever *B* is constrained to move over a greater arc than member *A* and a correspondingly longer stroke is given to the reciprocating slide linked to lever *B*.

Fig. 2 shows the positions occupied by the several levers and connecting-rod *K* near the terminal points of the stroke movements imparted to the two slides.

The heavy lines show the lever positions when

about to start their outward working strokes. The broken lines indicate the corresponding positions of the levers when they are about to start their return movements. The slide linked to lever A is thus constrained to move the horizontal distance X, which is less than the distance Y traversed by the slide connected to the lever B.

By adjusting stud M along its slot to lie nearer to stud D, the length of stroke imparted to its slide is increased. Conversely, moving stud M to a greater distance from the fulcrum D produces a shorter length of stroke. The movements of the lever A, however, remain substantially the same at these different settings.

## Crank-Driven Plate Obtains Near-Uniform Velocities Through Compensating Cam

By W. M. FOSTER, New Hyde Park, N. Y.

In a certain manufacturing process, sheets arriving on one conveyor section are transferred to another section by means of a suction plate. This plate is crank-driven through a connecting-rod and has a straight-line movement between the ends of the sections. Sheets arrive at regular intervals, and it is essential that the movement of the suction plate be synchronized and approximately uniform during the pick-up and deposit of each sheet, since the transfer cannot be made instantaneously.

The design of the transfer mechanism created a problem, because simple linkage would obviously convert the constant angular velocity of the crank to a continuously varying linear velocity of the suction plate.

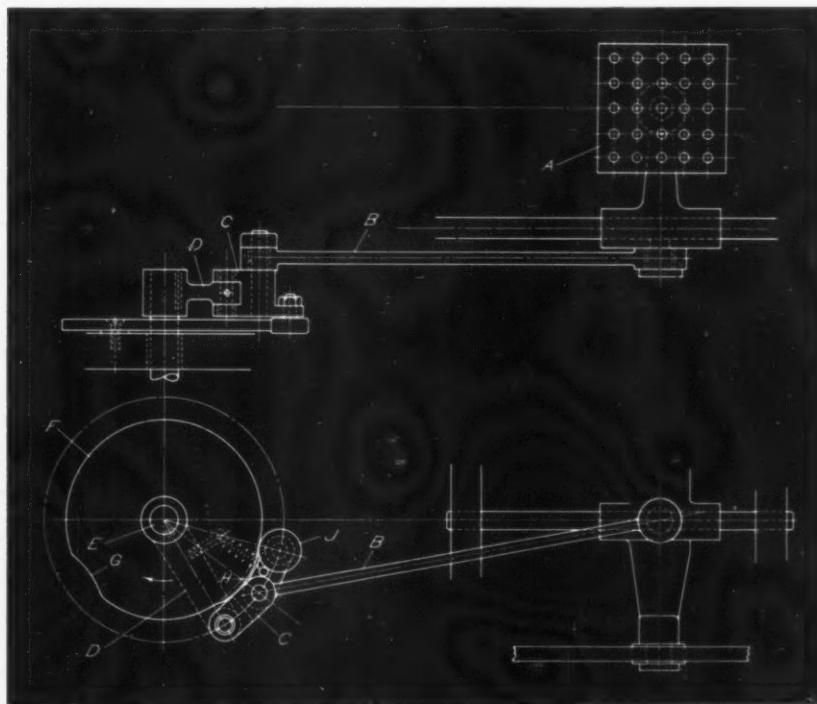
The time in the cycling of the plate when a uniform movement was wanted corresponded to 10 degrees of crank rotation during the pick-up of the sheet, and another 10 degrees during its deposit.

A compensating cam provided the answer. As can be seen in the accompanying illustration, suction plate A is joined by connecting-rod B and link C to crank D. The crank is keyed to drive-shaft E which rotates at a constant speed. Compensating cam F, having a drop

G and a rise H, is fixed against moving, being fastened to the frame of the mechanism.

At one end, link C carries a roll J which is spring-loaded against the periphery of the cam. The drive-shaft rotates clockwise. When the roll contacts the drop on the cam, the effective length of the crank is decreased, and, thus, the velocity of suction plate is reduced. Conversely, the velocity of the suction plate is raised when the roll is on the rise on the cam.

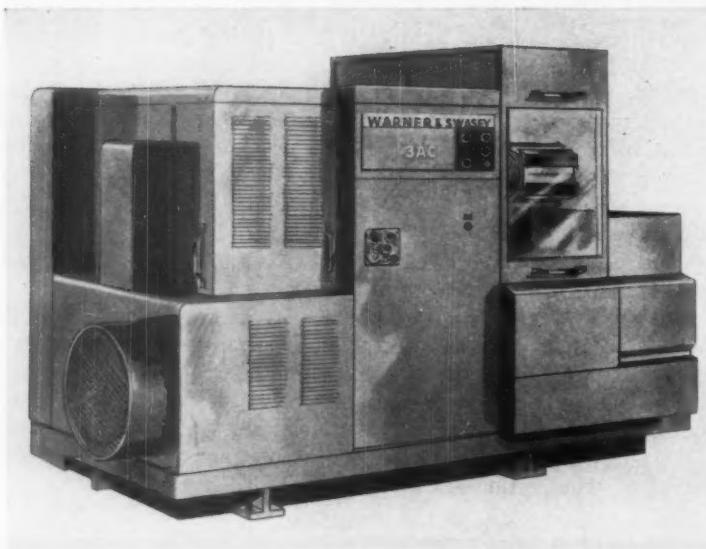
The drop and rise areas are so located on the cam as to produce the near-uniform velocities at the desired points in the cycle of the suction plate. In one instance, an unwanted acceleration of the plate is cancelled by a drop in the cam, and in the other instance, an unwanted deceleration is cancelled by a rise in the cam.



The net effect of compensating cam (F) is to produce near-uniform velocities at two points in cycle of suction plate (A).

## LATEST DEVELOPMENTS IN

# Shop



Single-spindle, automatic chucking machine announced by Warner & Swasey

### Warner & Swasey Single-Spindle Automatic Chucking Machine

The Warner & Swasey Co., Cleveland, Ohio, has announced a 3AC, single-spindle, automatic chucking machine designed for fast automatic machining of large, complex work-pieces. This machine is built to give high accuracy and permits quick setups. It is adapted for short as well as long production runs on large-size precision work.

During the machining cycle, automatic regulation is provided for the spindle speeds, feed changes, cutting stroke length, turret indexing, and both front and rear cross-slide operation. Speed and feed changes can be made while the machine is cutting. The operator has only to load the work-piece, press the cycle start

button, and unload the finished work when the machining operation is completed. As many duplicate pieces as desired can be produced in succession without resetting the machine controls.

The machine can be set up quickly through a simple placement of switch-operating screws in the index control drum which regulates the various machine functions, and by setting easily adjusted trips on the pentagonal control drum for desired feed rates, spindle speeds, and cutting stroke lengths. No time-consuming cam changing is required, and the simplicity and accessibility of both the adjustments and tooling stations permit rapid, accurate setup.

Any six spindle speeds—from a

high range of 65 to 826 R.P.M. or a low range of 30 to 385 R.P.M.—may be selected and obtained automatically during the machining cycle. An arrangement of hydraulic clutches in the speed transmission eliminates the need for changing speed pick-off gears. A range of thirty-six feeds, from 0.0019 inch through 0.124 inch, is available. Any six of these feeds may be selected during setup by placing the proper change-gears in the readily accessible feed transmission gear-box and adjusting the trips on the pentagonal control drum. Change-gears can also be furnished to lead in taps or die-heads used in cutting right-hand threads from 7 to 32 threads per inch. A left-hand threading arrangement is available on special order.

The machine swings 13 1/2 inches over the cross-slide and offers a maximum pentagon turret working stroke of 11 inches. The spindle has an 11 inch, Type A-2, American Standard, flanged nose and is equipped with an air-operated 15-inch chuck. The standard driving motor is a 40-H.P., non-reversing type. Two-speed motors and reversing motors also are available.

### General Electric Atomic Hydrogen Welder

A complete redesign of its atomic hydrogen welder has been announced by the Welding Department of the General Electric Co., Schenectady, N. Y. The atomic hydrogen process applied by this welder is particularly useful in the repair of dies, molds, machine tools, and oil well bits,

# Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

and with materials such as high-alloy steels, chromium, nickel, and molybdenum. In the atomic hydrogen process, a jet of hydrogen is directed across the arc formed between a pair of tungsten electrodes. This generates atomic hydrogen which recombines at a short distance from the arc to form molecular hydrogen. This action, in turn, results in intense heat concentration in a small area shielded by hydrogen.

The operator can control the heat applied to the work by either varying the distance separating the two tungsten electrodes or by varying the distance of the arc from the work. Metal of approximately the same analysis and strength as that being welded can be deposited, usually without flux.

An automatic hot start device that gives a current surge for positive starting (particularly at low current settings) and power factor capacitors are standard equipment on the atomic hydrogen unit. Gas flow is controlled automatically,

flowing only when the arc is struck between the two electrodes. Gas consumption ranges from 30 to 90 cubic feet per hour during manual operation. The current range of the unit is from 7 to 100 amperes.

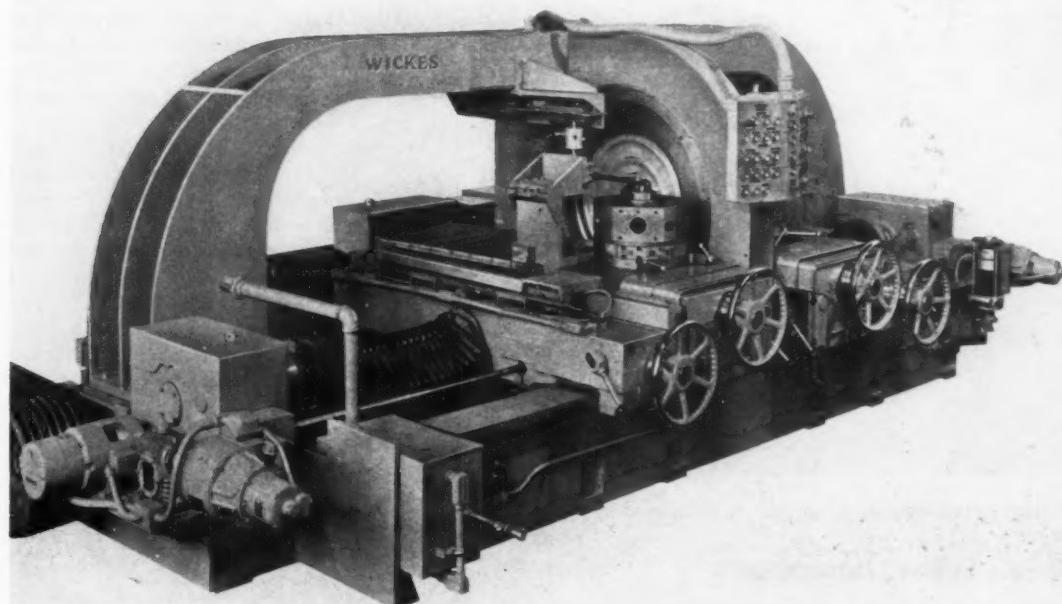
## Wickes Center-Drive Facing Lathe

A center-drive lathe designed for profile-facing such pieces as turbo-jet engine discs ranging up to 44 inches in diameter has been announced by the Wickes Machine Tool Division of the Wickes Corporation, Saginaw, Mich. Cutting tools, mounted on opposite sides of the work-piece, simultaneously face both sides. Roughing, semifinishing, and finishing cuts have been made with this ma-

chine on very thin parts, 22 inches in diameter, on which the parallelism of the opposite sides was held within limits of 0.001 inch.

An electronic feed system operating in conjunction with differential potentiometers is arranged to drive the feed motors so that proper balance is maintained throughout the complete cycle. The spindle speed control for any predetermined surface speed is

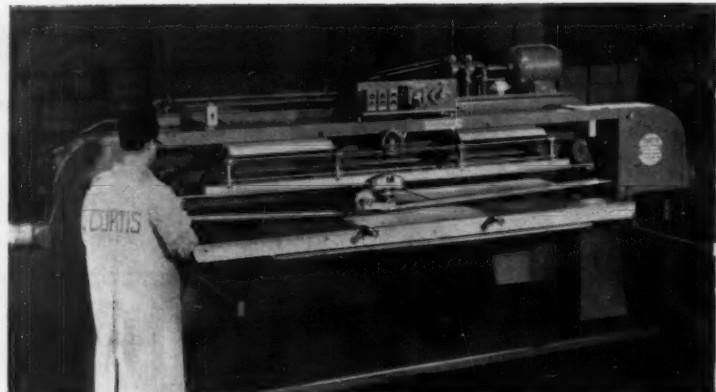
Center-drive lathe for profile-facing both sides of turbo-jet engine discs simultaneously  
announced by the Wickes Machine Tool Division of the Wickes Corporation



achieved by a cam-controlled, variable-speed drive unit.

This lathe, designated Model CDF, is said to eliminate undesirable "dishpan" effect so often prevalent in thin sections machined by conventional methods. It is available in six sizes with the longitudinal travel either toward or from the center line varying from 24 or 12 inches to 36 or 18 inches, depending on the model.

Circle Item 103 on postcard, page 233



Curtis hydraulic automatic-stroke polishing machine

### Hydraulic Automatic-Stroke Polishing Machine

The Curtis Machine Division, Carborundum Co., Jamestown, N. Y., has brought out a hydraulic, automatic-stroke polishing machine adapted for the use of stainless steel fabricators whose production does not warrant the purchase of a wide-belt sheet polisher. This Model 43-R3 polishing machine will polish either 2B roll mill sheets or formed flat surfaces equivalent to a No. 4 finish or better. It employs a hydraulic system which drives a traveling head having an 8-foot stroke at a speed of eighty to ninety strokes per minute. Longer strokes are also possible.

A buffing roll mounted on the traveling head backs up the 6-inch wide abrasive belt with a "soft" pressure that gives uniform finish.

The stock table reciprocates under the belt while grinding pressure is exerted either by manual or air-pressure control. The scratch pattern created is longer than that of mill-furnished standard No. 3 or No. 4 finishes, but more nearly approximates the final finish given

fabricated products. It is also easier to simulate by hand. The machine can be built to accommodate stock of any length or width. It can also be used for weld removal, surface cleaning prior to painting, and scale removal.

Circle Item 104 on postcard, page 233

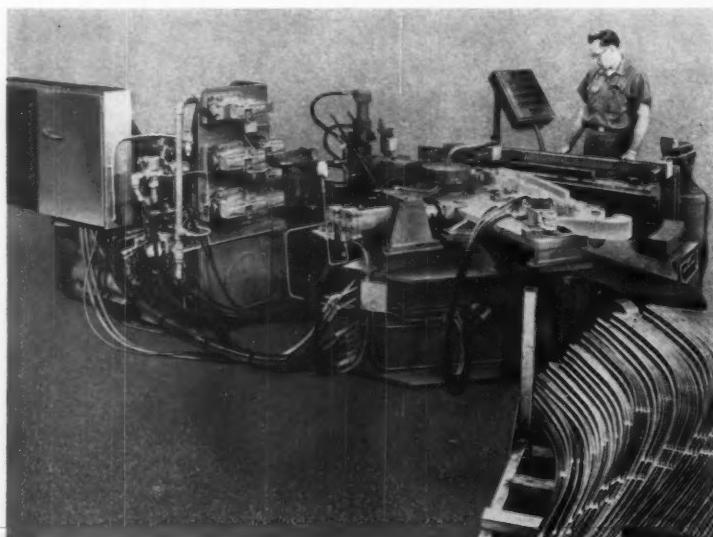
### Cyril Bath High-Speed Metal-Forming Machine

A new type of high-speed automatic metal-forming machine has been developed by the Cyril Bath Co., Solon, Ohio, in collaboration with the engineers of the Chrysler Corporation. These machines are designed to raise—by better than 200 per cent—the production of body trim, roof sections, and other

components for the modern passenger car.

High speed and automation are outstanding features of these radial draw-forming machines. Two small trim machines of this type are producing trim at the rate of over 700 pieces an hour, as against the rate, under older methods, of about 200 an hour. The larger drip-molding formers are designed to give an increased production rate of at least 200 per cent. Another advantage of these machines is their increased accuracy which makes it possible to hold finished parts to size within 1/64 inch on both cross-section and contour dimensions.

These machines employ automatic loading, cycling, and ejecting at very high speeds. The piece to be formed is fed automatically into the machine where the ends are grasped by gripper heads attached to hydraulic stretch cylinders and are then automatically stretched under a pull of 6 tons. The two die elements are next pivoted or rocked into mesh with each other under a pressure of 4 1/2 tons, completely forming the piece. The formed piece is then automatically ejected, a new piece



High-speed metal-forming machine announced by the Cyril Bath Co.

is fed to the gripper jaws, and the cycle is repeated. With this equipment, pieces can be turned out at the rate of 500 per hour.

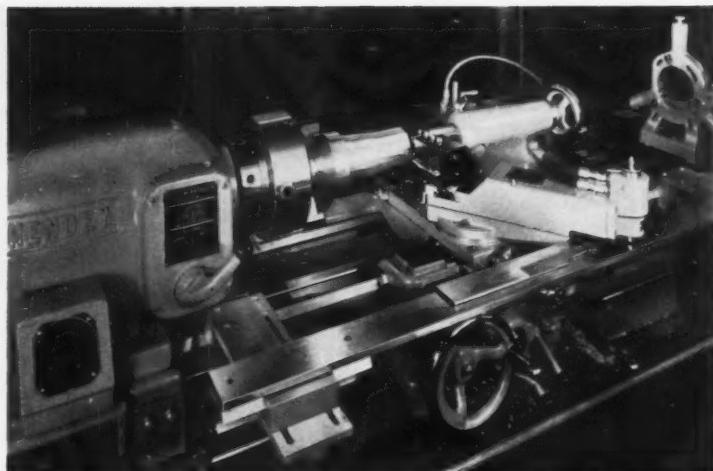
A notable characteristic of these radial draw-forming machines is the ability to form all types of metal regardless of hardness, and to form them with curves and reverse curves up to a full 360-degree angle and in several planes. It is possible also to handle tapered pieces, as well as pieces with a standard cross-section. Depending on the size of the machine, pieces can be formed up to 33 feet long and 9 feet wide.

Circle Item 105 on postcard, page 233

### Cincinnati Shear for Cutting Steel Road Mesh

A 4314 Series All-Steel shear is one of several special machines built recently by the Cincinnati Shaper Co., Cincinnati, Ohio, for cutting steel road mesh of the type used to reinforce concrete roadways. This shear requires no hold-downs to clamp the material while the cut is being made. However, an adjustable work guide is provided to prevent the material from "tipping up" during the cut. These machines also feature electric clutch control, and are set up in conjunction with automatic material-feeding units that minimize manual handling.

Circle Item 106 on postcard, page 233



Lathe equipped with hydraulic tracer attachment announced by the Hendey Machine Division, Barber-Colman Co.

### Hydraulic Tracer Attachment for Lathe

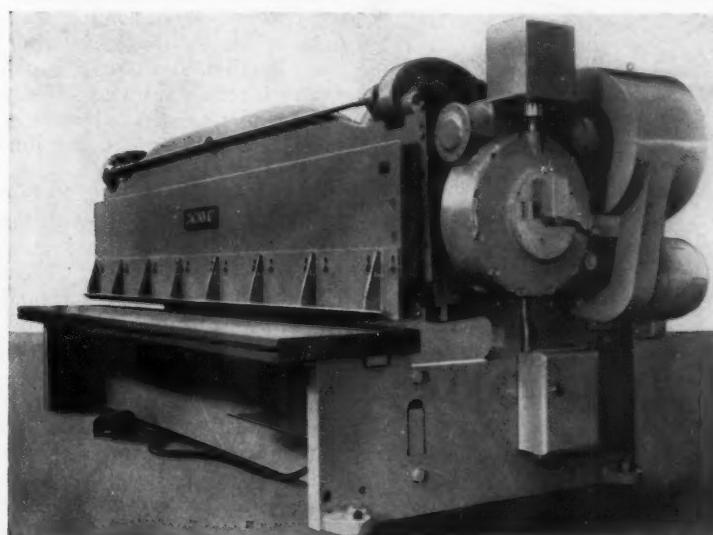
A hydraulic tracer attachment which will adapt the No. 2E general-purpose lathe to production turning jobs is announced by the Hendey Machine Division, Barber-Colman Co., Rockford, Ill. This attachment serves to convert a general-purpose lathe into a production machine at relatively low cost. The machine can be reconverted simply by removing the hydraulic tracer control and template-mounting brackets. Since the tracer unit comes as a complete package with the pump and sump mounted on the floor at the

rear of the machine, no additional external plumbing connections are required.

Mounting of the tracer itself is extremely simple and requires no drilling or tapping of holes for either the tracer attachment or the template bracket. The tracer attachment replaces the standard compound rest and is held in place by the two bolts.

A flat template is used for all production turning operations, the template being mounted at the front of the machine. The low cost of the template is said to make feasible even a relatively modest production run. The combination of tracer turning and the Hendey stepless speed control that is a feature of the No. 2E lathe permits the machining job to be done at the right speed and feed to give an outstanding surface finish. The close tolerances and fine finishes obtainable on this lathe are said to enable the user to reduce or eliminate second-operation finish turning work.

The ability to change speeds even when the spindle is under load enables the machine to turn at virtually constant surface speed since the operator has available an infinitely variable electronic drive—from 15 to 1500 R.P.M. Instantaneous dynamic brake assures faster stopping and reversing of the spindle. The Hendey No. 2E lathe is driven by a 5 H.P.



All-Steel shear for cutting steel road mesh

230-volt direct-current, variable-speed motor. Power for the motor is provided by the rectifiers in the electronic panel which convert three-phase, 60-cycle alternating current to direct current. The machine requires a floor space 42 by 104 inches, and the tracer weighs slightly in excess of 4000 pounds.

Circle Item 107 on postcard, page 233

### Dual-Slide Presses Built to Extrude Piston-Pins

Two 100-ton mechanical presses have been designed and built by Danly Machine Specialties, Inc., Chicago, Ill. These machines have two slides which exert sufficient horizontal pressure to extrude truck-engine piston-pins approximately 3 1/4 inches long.

Each press is completely automatic, and production capacity is approximately 2500 pieces per hour. An attached hopper supplies short lengths of bar stock to the feeding mechanism for extruding to size, including inside diameter and length. Approximately 43 per cent more raw material was required when the pins were produced by the process previously employed.

Circle Item 108 on postcard, page 233



Power-assist Rigidmil router brought out by the Sundstrand Machine Tool Co.

### Sundstrand Power-Assist Rigidmil Router

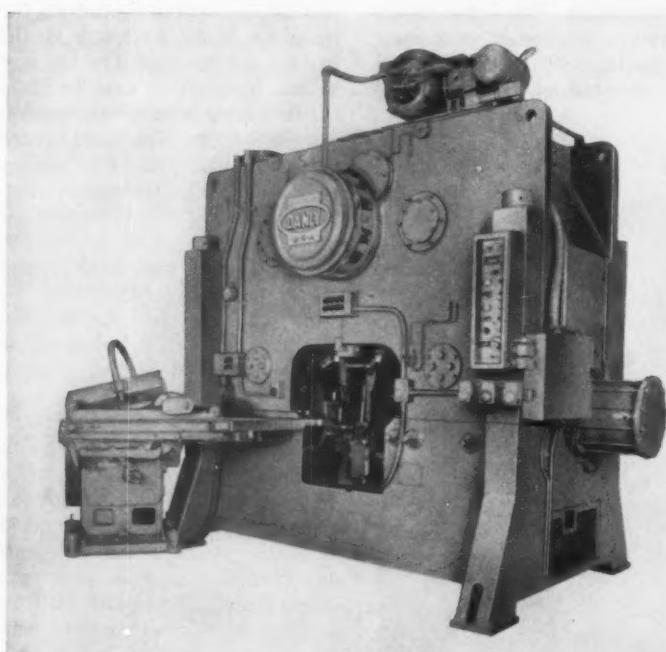
The Sundstrand Machine Tool Co., Rockford, Ill., has announced a power-assist Rigidmil router that affords maximum efficiency with a minimum expenditure of energy—the power-assist mechanism supplying the force required to feed the cutter through the work. Sizable work capacity is provided by a four-speed vertical spindle head

having a rating of 15 H.P. at a speed of 7200 R.P.M.

Power is furnished for all three basic movements required in machining with the Rigidmil router. Longitudinal movement of the gantry and transverse movement of the saddle are controlled by the operator through the power-assist mechanism. Depth movements are controlled by a conveniently located push-button unit with the downward feed being limited by a six-station manually indexed turret stop mounted on the saddle. Spindle speed changes are obtained by means of push-buttons located on the power-assist handles. The rigidly braced gantry is arranged on an angle to permit an unobstructed view of both the follower and cutter during an operation.

The stationary table is 19 feet long by 5 1/2 feet wide, with the spindle center covering a rectangular area over the table, 12 feet long by 5 feet wide. Feed and rapid traverse rates are both determined by the amount of manual pressure exerted on the power-assist handles by the operator. It is claimed that the conventional routing feel and control is not lost by the use of the power-assist mechanism. Either offset routing or overlay template work can be readily handled.

Circle Item 109 on postcard, page 233



Danly dual-slide extruding machine with hopper that automatically feeds raw material to the extruding and ejecting mechanism

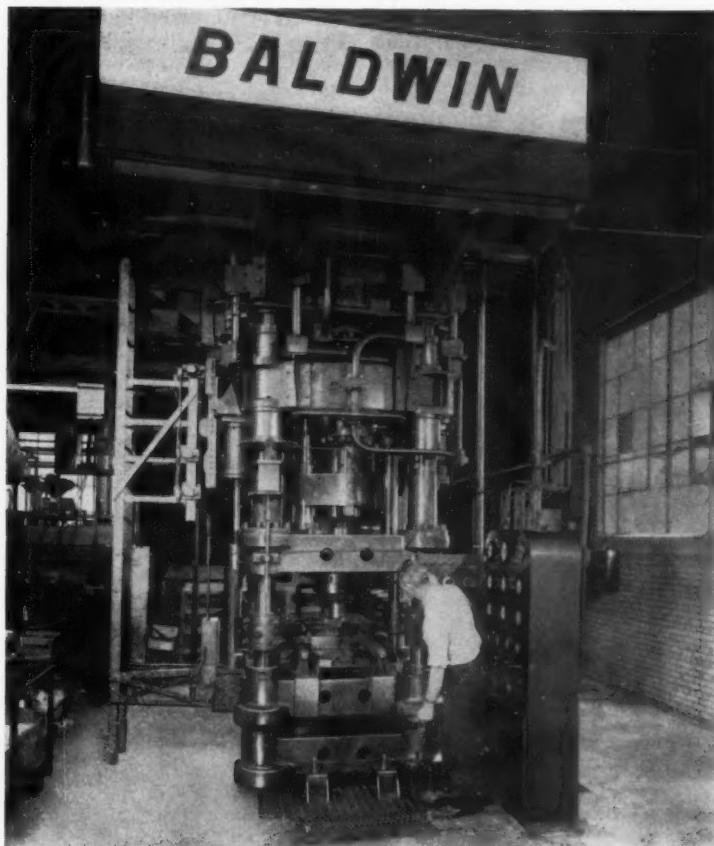
### Hydraulic Metal-Powder Compacting Press

A Model 300-H, hydraulic, metal-powder compacting press which is said to mark an important advance in the field of powder metallurgy has been developed by the Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. The design of this press follows the concept of compacting introduced by the manufacturer's earlier mechanically operated Models C and L presses. The 300-H press has a greatly extended range of part sizes and shapes which can be compacted. For instance, it enables fabricators to produce, without additional tooling, such shapes as a double counterbore (a counterbore in each end of the part) and a double hub (a hub on both sides of a flange). Variations of these shapes are possible; a double-hub part can be made with both counterbored and through holes. A double-counterbored part can also be made with an offset or flanged section on the outside.

The Model 300-H is a 300-ton, four-column hydraulically operated press with the main pressing platen moving down from the top. Mounted on the platen are four auxiliary cylinders; two of which are connected to an inner top punch platen and two to an outer top punch platen. The main platen exerts a force of 300 tons, and the auxiliary cylinders can be adjusted up to a maximum pressure of 125 tons. Adjustable stops from the main platen to the two punch platens (of 300 tons capacity) permit loading either top punch up to this capacity as long as the total of the two does not exceed 300 tons.

The die platen, held in its top position by two air cylinders, is equipped with 300-ton adjustable stops to limit its downward movement. The bottom, or ejector platen, is operated hydraulically with a maximum force of 300 tons.

Circle Item 110 on postcard, page 233



Baldwin-Lima-Hamilton hydraulic metal-powder compacting press



Tanneowitz variable-speed band saw

### Variable-Speed Band Saw

The Tanneowitz Works, Grand Rapids, Mich., have recently placed on the market a small, powerful variable-speed band saw, designated EV-24, which has wheels 24 inches in diameter. This band saw can be operated at any speed from 300 to 6000 R.P.M.—a range which permits sawing nearly any wood or metal material.

At the low speeds, it will saw any light cast iron, bronze, or cast brass. At the intermediate speeds, it will saw standard bronze, yellow brass, aluminum, magnesium, etc., and at higher speeds, it is said to be capable of sawing any sheet metal, whether steel, brass, or aluminum, either formed or flat, and, in the latter case, several sheets at a time.

The table is 24 by 28 inches and can be tilted and locked at any angle from 15 degrees left to 45 degrees right. The band saw is motor-driven and equipped with push-button controls and overload and low-voltage protection. It has a heavy cast frame; fully enclosed, carefully balanced wheels; quick acting foot-brake; roller guide supports; a guard which makes it possible to cover the saw blade above the guide at all times; and a number of other features usually found only in the large high-speed band saws.

Circle Item 111 on postcard, page 233

### **Etco-Emrick Eight-Station Drilling, Tapping, Reaming, and Deburring Machine**

Ten holes are drilled, four are deburred, and two are tapped simultaneously and automatically in an aluminum alloy (P-7083) die-casting on a special Etco-Emrick four-way drilling and tapping machine built by the Etco Tool & Machine Co., Inc., Brooklyn, N. Y. The part processed on this machine is a plate-cast stator for the magneto of a small gasoline motor. Production is at the rate of 400 pieces per hour.

This multiple drilling and tapping machine consists basically of two of the company's standard vertical drill units—one vertical automatic lead-screw tapping unit and one horizontal drill unit. These assemblies are mounted on a standard cast-iron machine base with built-in coolant tank and pump. Electrical controls and wiring conform to JIC standards. Tooling for the part consists of an eight-station Etco-Emrick index-table with eight nests to receive the part.

Operation of this machine con-

sists simply of unloading one part and reloading another in the load station over two locating pins and pressing a button which sends an electrical impulse to the index fixture. This causes the loaded part to be indexed to the work-stations, and actuates the four units which simultaneously perform the required drilling, reaming, deburring, and tapping operations. At the end of this machining cycle, which produces one completed part, all units automatically return to the starting position, and the cycle is repeated.

*Circle Item 112 on postcard, page 233*

### **"Westbury" Universal Dial Type Milling Machines**

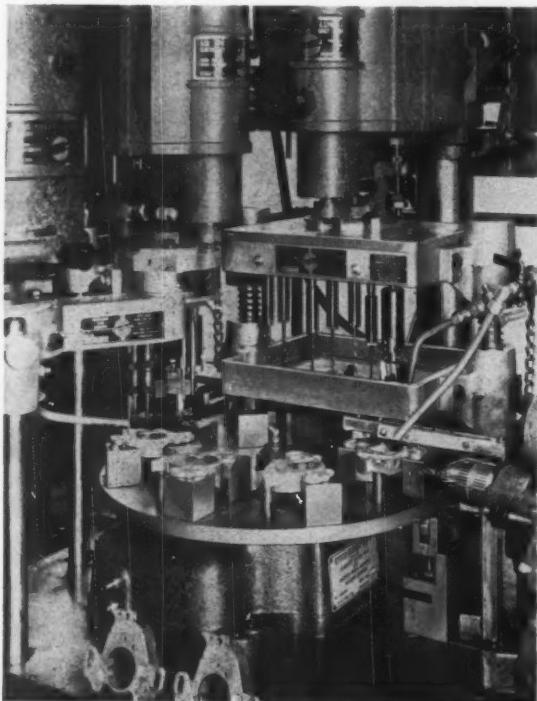
The Aaron Machinery Co., New York City, is introducing in this country a line of "Westbury" universal dial type milling machines featuring hardened and ground spindle and gears, tapered roller bearings, climb milling, and hand-

scraped ways. These machines are designed for great power, speed, and precision control.

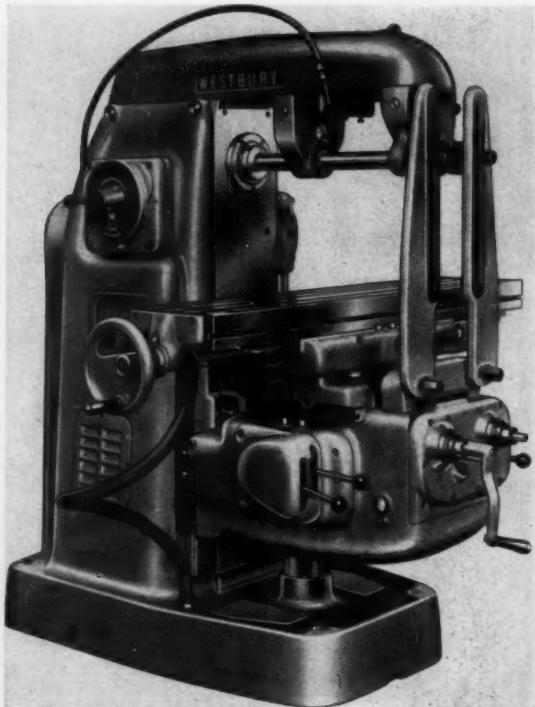
The line consists of three horizontal universal milling machines—1-U, 2-U, and 3-U. These machines have heat-treated, hardened chromium-nickel spindles with all working parts designed to withstand an overload of more than 100 per cent. The same lever operates both the multi-disc clutch and brake for the spindle control. There are twelve spindle speeds—from 28 to 1100 R.P.M.—with dial and hand control for selecting and reversing speeds. Power is transmitted from the spindle gear-box to the feed-box in the knee of the machine through a vertical shaft mounted on tapered roller bearings.

The feed-box operates in oil with all feeds selected by dial with a single hand control. All movements can be controlled and operated separately or simultaneously. A single lever will engage rapid traverse to the longitudinal, transverse, and vertical feeds by means of a tapered clutch.

*Circle Item 113 on postcard, page 233*



Close-up view of special Etco-Emrick multiple drilling and tapping machine



Universal dial type milling machine of "Westbury" line introduced by the Aaron Machinery Co., Inc.

## "Semspak" Portable Power Screwdriver

A portable, self-feeding, completely automatic power screwdriver has been developed for mass-assembly operations by the Shakeproof Division of the Illinois Tool Works, Elgin, Ill. This tool, called "Semspak," drives screws automatically at any angle and as fast as the operator can pull the trigger. Each screw is automatically fed into the driving jaws from a cartridge which holds sixty No. 8 screws and slightly less No. 10 screws. The screw is held tightly in place until it is started into the work-piece.

The tool allows the operator free movement around the work being assembled and will not "shoot" screws because they are automatically locked into the driving jaws and are not released until the thread is engaged. The screw supply is always visible and is quickly replenished by replacing the screw cartridge.

The tool accommodates screws having a minimum length of 7/16 inch and a maximum length of 1 1/2 inches with either round,

pan, oval, flat, fillister, hexagon, slotted, or Phillips heads. It is 18 inches long, and weighs 6 1/2 pounds. Only one lightweight air hose is required to provide the power. The torque can be quickly adjusted. Bits for different screw sizes and heads can be interchanged without the use of special tools.

Screw cartridges are loaded from an automatic electric hopper which can be used to supply several "Semspak" drivers. Several loaded cartridges can be kept ready and 1 1/2 cartridges of screws are always in reserve in the hopper track.

Circle Item 114 on postcard, page 233

## "Micro" Press

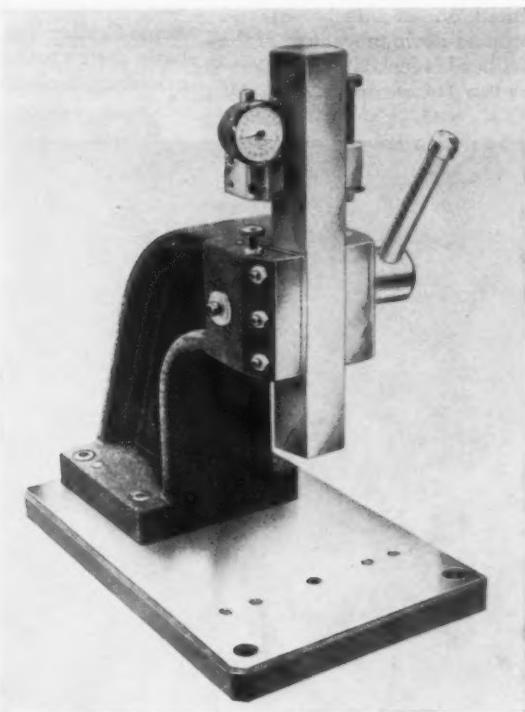
A precision "Micro" press designed for piercing, broaching, forming, press-fitting, and burnishing operations has been brought out by the Queens Tool Mfg. Co., Inc., Rockville Centre, Long Island, N. Y. This press is constructed to give maximum accuracy with respect to ram alignment and depth control.

The machine-steel, pack-hardened ram and the gear rack are constructed as a single unit. After machining, the teeth are milled, and the ram pack-hardened and then precision ground in line with the 0.500-inch locating hole in the end of the ram. The machine-steel pinion is made in two pieces, with the larger end (handle side) a close running fit in a bronze bushing pressed into the frame. The micro stop, also of machine steel, is of two-piece construction, chromium plated, and accurately machined.

One half of the stop engages one tooth of the gear rack for positive locking. The stop is quickly placed in any desired position of the ram by means of a clamping screw. On the right side of the stop is a fine-threaded, quick-adjusting screw with lock-nut bearing against a hardened stop plug in the frame. On the left of the stop there is a dial indicator with 0.001-inch graduations which bears against a fine-thread adjustable stop-screw. A 1-inch ram adjustment can be made by adjusting the screws before placing the stop in the next tooth in the gear rack.



"Semspak" portable power screwdriver



"Micro" press built by Queens Tool Mfg. Co.

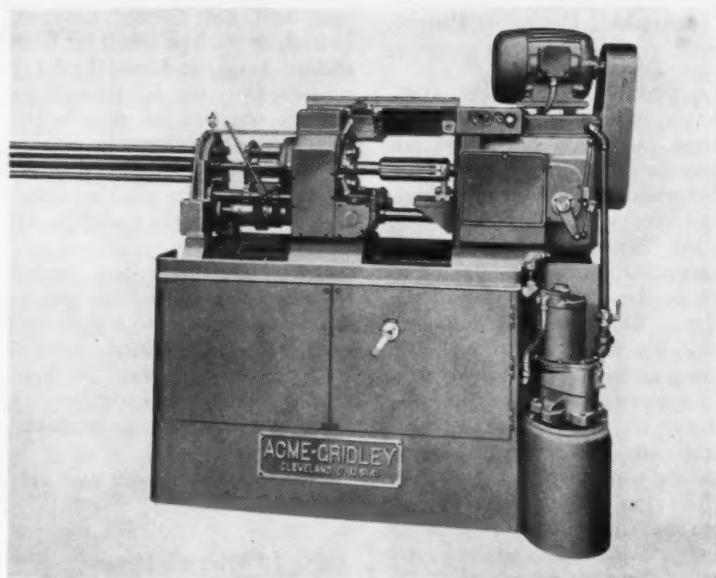
The throat depth from the center of the ram is 4 7/8 inches, the maximum distance from the ram to the base is 7 inches, and the minimum distance 1 3/4 inches. The size of the work area, left-to-right, is 8 3/4 inches and front-to-back 7 3/4 inches. The ram is 1 1/4 by 1 3/4 by 11 1/2 inches. Maximum leverage ratio is 22 to 1 and the maximum pressure capacity 880 pounds. The press has an overall height of 14 inches and a shipping weight of 78 pounds.

**Circle Item 115 on postcard, page 233**

### Two-Wheel Copy Grinder

Two identical cutting tools, profile gages, or production parts can be ground simultaneously on a Copyrex machine introduced by Carl Hirschmann Co., Inc., Manhasset, N. Y. An easily made template, five times tool size, controls the copying process by parallelogram linkage to twin tool-holders. A pair of diamond dressers keeps wheels trued. During the operation, the template is fed against a stationary copying finger, and the wheel-head carriage reciprocates up and down to traverse the wheels against the work surfaces. For circular tools, the work is mounted on an attachment and the up-and-down movement of the wheel-head is locked out.

**Circle Item 116 on postcard, page 233**



Smallest and fastest member of the line of Acme-Gridley automatics built by the National Acme Co.

### National Acme Multiple-Spindle Bar Automatic

A 7/16-inch, RA-6, multiple-spindle bar automatic has been announced by the National Acme Co., Cleveland, Ohio. Developed especially for the manufacture of small, high-production parts, this smallest and fastest member of the Acme-Gridley line provides all the basic design features of the larger machines. Included in the tooling

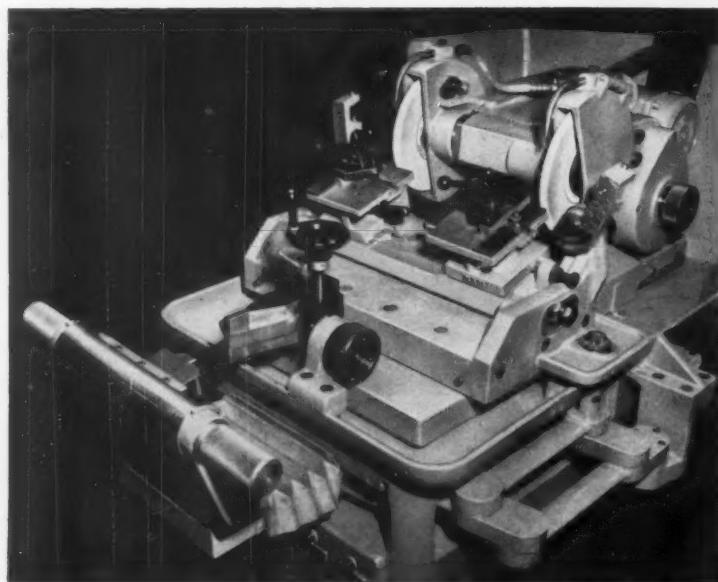
are the usual second-operation attachments.

Although the machine is only approximately 5 feet high and 5 1/2 feet long (16 feet including the stock reel), the working position is high enough for the operator to work in an erect and comfortable stance. Spindle speeds up to 4500 R.P.M. are available on standard models and up to 3200 R.P.M. on models equipped with a spindle stopping mechanism. Although the spindle capacity is 7/16 inch, using standard collet and pusher tubes, it can be increased by using combined pushers and pusher tubes to accommodate 1 1/2-inch round or 7/16-inch hexagonal stock.

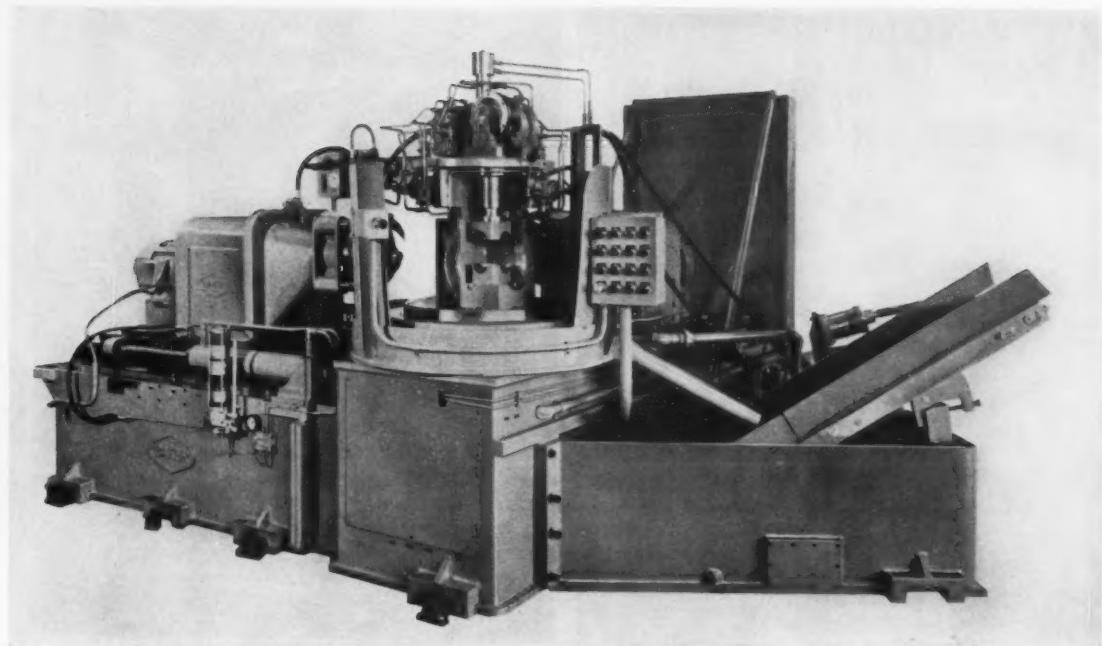
The tool-slide is of the standard Acme-Gridley flat surface design with center keyway and parallel T-slots for holding down the hinge type tool-holders that are furnished at each spindle station. These allow the use of standard types of end-working tools.

The complete cycle of the automatic is 0.7 second at high speed. The high-speed segment of the drum shaft is approximately 240 degrees which will allow an idle time of 0.466 second added to the machining time.

**Circle Item 117 on postcard, page 233**



Copyrex machine marketed by the Carl Hirschmann Co., Inc.



Machine built by Baker Brothers, Inc., for finishing both ends of steel elbows simultaneously

### Baker Two-Way Indexing Machine for Processing Steel Elbows

A horizontal two-way indexing machine that faces and chamfers both ends of a steel elbow simultaneously, making it ready for welding, has been built by Baker Brothers, Inc., Toledo, Ohio. The electric-powered index-table has

two positions. The heads are designed to target into the fixture to obtain greater rigidity. Single-point carbide tools are mounted on sliding catheads which are piloted from the inside diameter of the elbow.



Presslite lighting units mounted on both sides of a large press die-bed illuminate the complete die area

Operation of this machine is automatic, the operator simply loading and unloading the work at one station. Production at 100 per cent efficiency is 146 pieces per hour on 1-inch elbows and 27 per hour on the 4-inch size. Speed changes for different size elbows are accomplished quickly by pick-off gears on the drive bracket. Fixture jaws are replaceable for different diameter elbows. The machine is composed of standard components that can be adapted to other uses such as boring, drilling, and tapping.

Circle Item 118 on postcard, page 233

### Presslite Machine Lighting Units

A line of Presslite machine lighting units designed to provide glare-free illumination of the entire die-bed area of punch presses now in service is announced by the Sun-Lite Mfg. Co., Detroit, Mich. These lighting units are said to eliminate eyestrain, reduce operator fatigue, and assure greater on-the-job safety. Their use also results in higher production with fewer rejects and less danger of damaging dies.

A unique feature is the "Plexi-

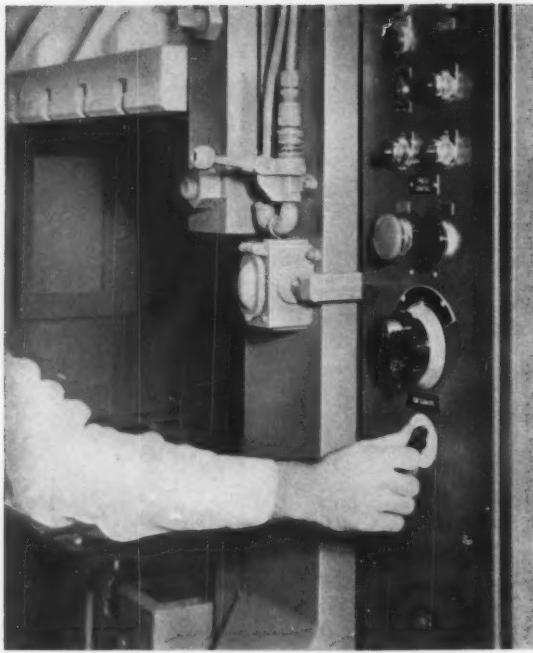


Fig. 1. Clearing press with built-in die lights



Fig. 2. Flextrol-equipped Clearing press

lux" louvered shield. Made of shatterproof, oil-resistant Plexiglas, these louvers eliminate all glare from the enclosed lamps but permit high light transmission with low surface brightness. The

louvers facilitate either vertical or horizontal mounting of the lighting units. Five standard models are available for operation on 110-volt, 60-cycle current.

Circle Item 119 on postcard, page 233

#### Clearing Adjustable Die Lights and Flextrol Control Arm

The Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill., has designed a die light, Fig. 1, that can be adjusted to all shop conditions. A switch on the control panel en-

ables the press operator to vary the die light from "bright" to "off" through an uninterrupted choice of intensities. Die lights are built into the press upright and have frosted glass coverings. Adjustable die lights are available on all Clearing presses.

The Flextrol arm seen in Fig. 2 is a device designed to facilitate press operation and contribute to the operator's safety and efficiency. Since the correct positioning of controls varies from job to job, depending on different die setups, Flextrol has been designed to be completely mobile within the general area of its operation. The press operator can quickly re-position his operating buttons for maximum efficiency on each job.

Pedestals specially designed for use with the run button bar, like the one shown in Fig. 3, are also available. They feature a heavy

steel base, telescoping shaft with a rack mechanism for height adjustment. The pedestal is arranged for quick attachment of the run button bar.

Circle Item 120 on postcard, page 233

#### "Spin-Buffing" Machine for Finishing Die-Cast Parts

The Grav-i-Flo Corporation, Sturgis, Mich., has brought out a machine which employs a new process for finishing brass, zinc-base, and aluminum die-cast parts preparatory to plating. Known as "Spin-Buffing," the new process is said to eliminate the need for conventional hand and automatic buffing methods. A special-formula compound is used to produce surfaces and luster comparable to or surpassing those resulting from conventional buffing. Parts mounted in multiple holders are finished in a single, automatically timed operation.

No elaborate blowers and exhaust-ventilating systems are employed in the new machine developed for this process. "Spin-Buffing" is dust-free and fume-free, eliminating occupational hazards from these sources. One compound is used for parts of all

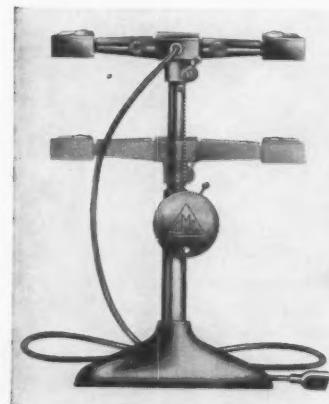
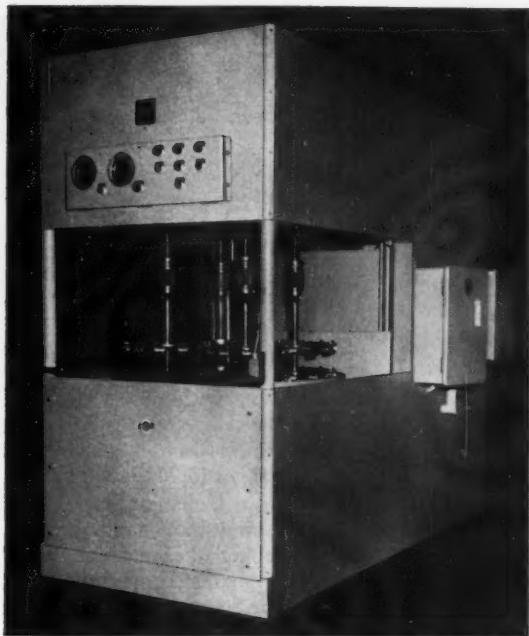
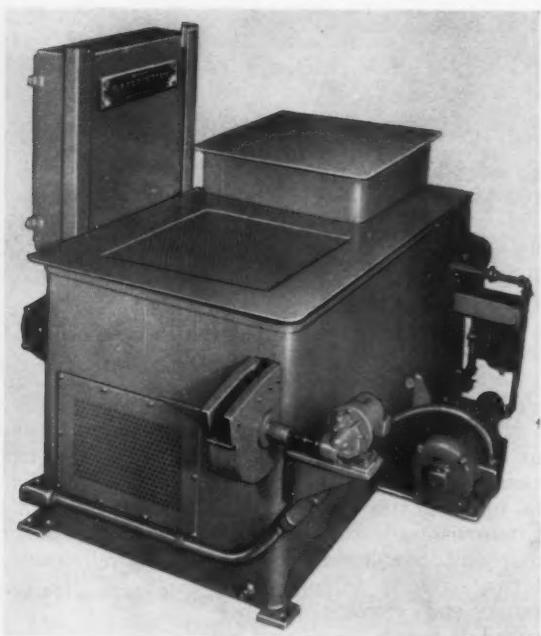


Fig. 3. Pedestal type Flextrol



"Spin-Buffing" machine developed by the Grav-i-Flo Corporation for finishing die-cast parts



Gear and small parts washing machine developed by Gear-O-Mation Division, Michigan Tool Co.

shapes and sizes. In addition to running a number of like parts in a single setup, groups of as many as four different parts may be run simultaneously. A high degree of finish control can also be maintained with the "Spin-Buffing" process. Operating cycles vary from four to sixteen minutes.

Circle Item 121 on postcard, page 233

#### Gear and Small Parts Washing Machine

A compact gear washing machine requiring a floor space only 3 by 5 feet has been developed by the Gear-O-Mation Division,

Michigan Tool Co., East Detroit, Mich. This machine operates at room temperatures and is not limited to the handling of gears or round parts. It can be used for any production line cleaning job where removal of either chips or loose dirt from relatively small parts is important to subsequent machining or inspection operations. Either a magnetic chip separator or self-cleaning filters are available as optional equipment.

Parts can be fed to the washer directly from other machines in the production line or they may be received from a floor conveyor. The washer will handle parts

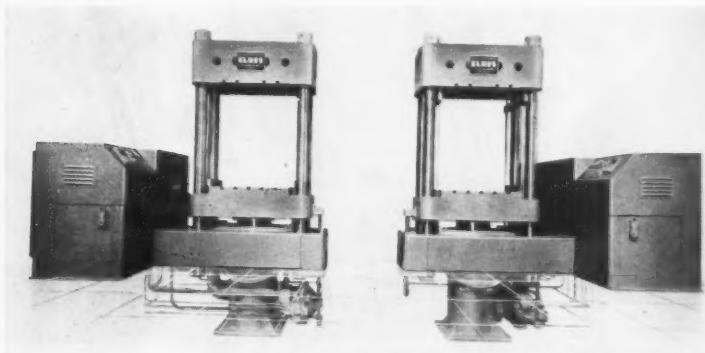
ranging from fractions of an inch to about 3 inches in diameter, or equivalent dimensions. Despite its compactness the unit can handle up to 1000 parts per hour. It spray washes and blows the parts dry as they travel a distance of 4 feet through the washer. A variety of washing solutions can be used.

Circle Item 122 on postcard, page 233

#### Twin Plastics Molding Presses for Easy Operation and Maintenance

Exceptionally easy operation and servicing are outstanding features claimed for twin, 300-ton Elmes hydraulic compression molding presses announced by the Elmes Engineering Division, American Steel Foundries, Cincinnati, Ohio. Both presses are of the four-column, upward-moving stroke type, and are identical except that one is equipped with left-hand and one with right-hand control and top knockouts. The two presses make a compact installation that can be operated by one man.

The hydraulic and electrical components and the piping of each press are encased in an individual metal cabinet which



Elmes twin plastics molding presses

keeps flash and excess material from getting into the units. This arrangement made possible location of all components close to the floor level, which, in turn, facilitated the location of the control panel within easy reach of the operator.

The principal specifications for each press are: die space, 36 inches left to right, and 30 inches

front to back; opening between platen and head, 44 inches; main ram stroke, 18 inches; and operating pressure, 2640 pounds per square inch. Operating speeds in inches per minute are 309 for the advance, 15 for the press, and 131 for the return travel movements. Provision is made for the addition of a transfer unit.

Circle Item 123 on postcard, page 233

### Special Machine for Duplex Milling, Drilling, Boring, and Reaming Transmission Housings

The Motch & Merryweather Machinery Co., Cleveland, Ohio, has brought out a special duplex machine designed to perform several operations in the processing of transmission housings for farm equipment. Simultaneous milling of two surfaces, drilling, rough-boring, and reaming are performed on twenty-seven parts per hour. The end of the machine where the operator loads the part in the fixture is shown in the accompanying illustration.

The table rapid traverses to the rear and then feeds past two opposed milling heads. After milling on the return traverse, three holes are drilled on one side and the cored opening at the neck of the case is rough-bored on the opposite side, simultaneously. The table advances to the third and final station, where three holes are reamed by the same six-spindle

head used in drilling these three holes. All operations between loading and unloading are performed automatically, and all movements and feeds as well as the work-holding clamps are hydraulically controlled.

Circle Item 124 on postcard, page 233

### "Safe-Torque" Tap Drivers

Three additional styles of "Safe-Torque" tap drivers are being offered to industry by Scully-Jones & Co., Chicago, Ill. The new styles, shown in the illustration, are the tension and compression, quick-change, and heavy-duty types. Basically, "Safe-Torque" tap drivers feature an overrunning roller drive design that releases instantly and completely when the pre-set torque is reached. The drive consists of a drive shell,

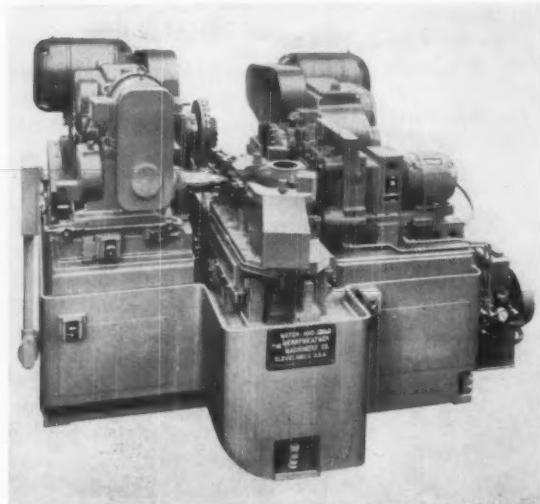
single or double set of rollers, and inner cam drive collet.

Tension and compression type tap drivers compensate for variations in feed between spindle and tap and release at pre-set torque rating when the hole is tapped. The tap floats in and out of the hole without over-cutting or under-cutting the flanks of the thread. When the tap is bottoming in a blind hole, the tension and compression feature cushions the shock and enables the tap to jump away from the last thread when being withdrawn. The two sizes offered cover a range of tap sizes from No. 10 to 5/8 inch, and torque ranges to 700 inch-pounds.

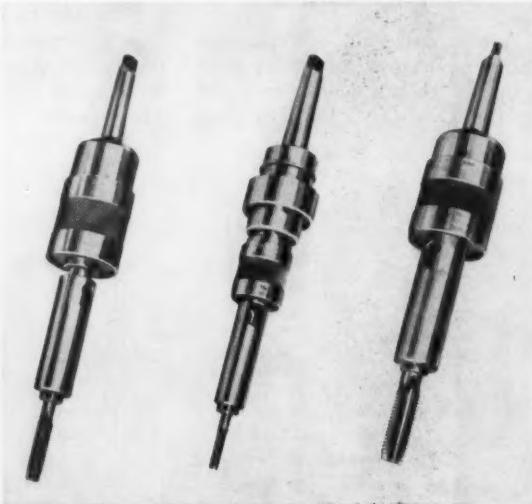
The quick-change type tap drivers permit tool changing without stopping the machine, thus speeding sequence operations involving drilling, reaming, and tapping. They are also shorter and have a smaller diameter than other drivers of the same capacity. Three sizes are available for a tap range from No. 10 to 1 inch. The torque ranges to 1900 inch-pounds.

Heavy-duty type tap drivers featuring the rugged double roller design provide quick and easy adjustment in addition to constant torque setting even on the toughest jobs. Two sizes cover a tap range from 1/2 inch to 1 1/2 inches and torque range from 500 to 2400 inch-pounds.

Circle Item 125 on postcard, page 233



Motch & Merryweather special machine equipped for processing transmission housings



Three styles of "Safe-Torque" tap drivers being introduced by Scully-Jones & Co.



Fig. 1. Sheffield "Precisionaire" gage for checking assembled ball bearing



Fig. 2. Internal measuring instrument announced by the Sheffield Corporation

### Sheffield Precision Gages and Measuring Instruments

Checking the end play in an assembled ball bearing can be accomplished rapidly and accurately with a "Precisionaire" gage, Fig. 1, brought out by the Sheffield Corporation, Dayton, Ohio. End thrust is adjustable in each direction along the axis of the bearing, and direct reading of the amount of end play is determined by the position of the float in the Precisionaire unit. Interchangeable plungers enable the gage to accommodate bearings within the following specifications: bore diameter 0.125 to 2.00

inches; width 0 to 1.750 inches; outside diameter 0.325 to 5.00 inches.

A Sheffield N-7 internal measuring instrument with dual electronic amplification of either 1000/2000; 2500/5000; or 5000/10,000 to 1 is shown in Fig. 2. With standard gaging arms, it is used to inspect internal dimensions from 0.370 inch to 12 inches. Special gaging arms provide a gaging range from 0.240 inch to 12 inches. A floor type base model is also manufactured. This instrument is adapted for heavy-duty shop and laboratory inspection of ring gages and other parts for diameter, bellmouth, and out-of-roundness.

An electronic gage cartridge and amplifier are shown in Fig. 3. This "Electrojet" cartridge is a transducer type pick-up unit 3/8 inch in diameter by 1 7/8 inches long. Teamed with the "Accutron" electronic amplifier this unit provides accurate, high-speed indication of part size over a wide tolerance range. The portable "Accutron" amplifier is available with five dual amplifications ranging from 1000/2000 to 1 up to 20,000/40,000 to 1.

Circle Item 126 on postcard, page 233

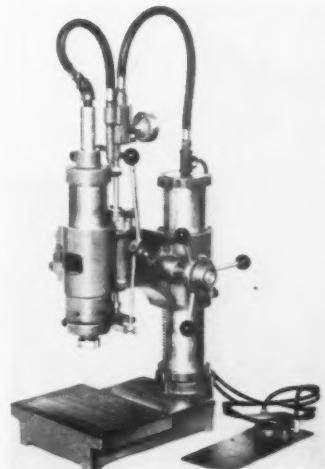


Fig. 3. Sheffield electronic gage cartridge and amplifier

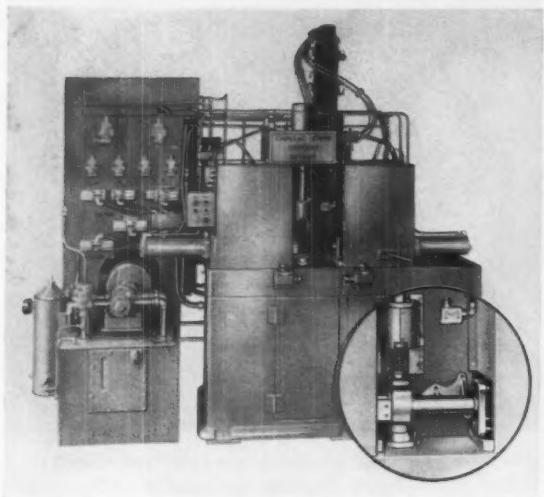
nation Model 300-VS. Engineering details of the redesigned machine conform with those of the other models in the VS or variable-stroke series. The Model 300-VS machine has about two and one-half times the impact capacity of the Model 200-VS described and illustrated in December, 1955, MACHINERY, page 222.

The VS air hammers are of the single-acting type, in which a heavy hammer strikes once each time the control valve is actuated. These machines are adapted for a wide range of staking, one-shot riveting, impression marking in metal, pressure assembling, and similar work.

Circle Item 127 on postcard, page 233



Impact hammer brought out by the Heidrich-Nourse Co.

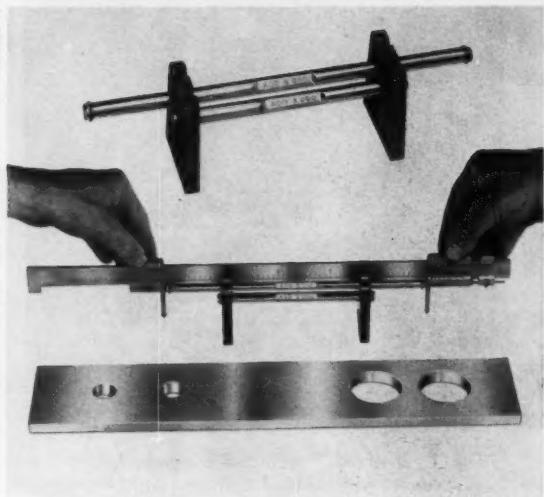


Cadillac machine designed for rapid automatic assembling of steering gear housing unit

### Assembling Machine for Steering Gear Housing Unit

The Machine Tool Division of the Cadillac Stamp Co., Detroit, Mich., has designed and built a machine that automatically assembles automobile steering gear housings. This machine has reduced the time required for the assembly operations to the following ten-second cycle: hopper feed and press in place one Welch plug; hopper feed and press in place two bushings; press in place one ball race; burnish holes in two bushings; and inspect diameter of holes in two bushings.

The accompanying illustration of the automatic assembly ma-



"Center-Mike" equipped with "Booster-Bar" to increase center-to-center measuring capacity

chine contains an inset showing the parts in place ready for the assembling operations.

**Circle Item 128 on postcard, page 233**

### "Booster-Bar" Increases Hole-Location Gage Range

Sorensen Center-Mikes, Inc., Bridgeport, Conn., has brought out a "Booster-Bar" accessory for its three sizes of hole-location gages. This device increases the

center-distance measuring capacity of the instrument. Each Booster-Bar assembly has two rods which are contained in plastic brackets slotted to hold the gage. The rods—one long and one short—give coverage for all combinations of hole diameters and center-spacing, from the normal range of the gage alone, to the extended range supplied by the Booster-Bar.

**Circle Item 129 on postcard, page 233**

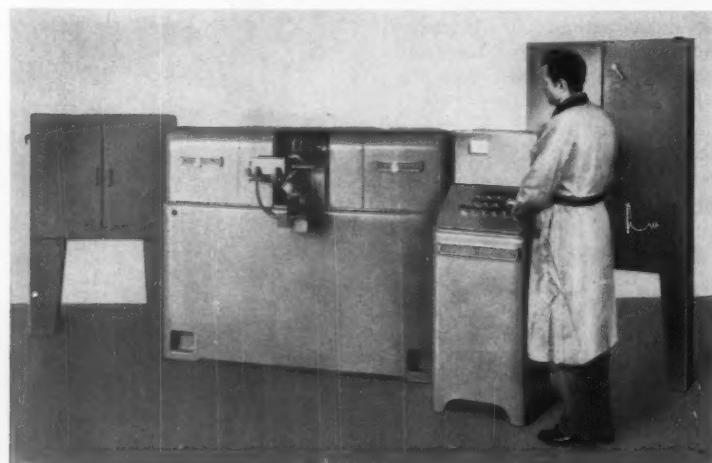
### Red Ring Electronic Gear Sound Inspection Unit

A Red Ring Model GSR electronic gear sound inspection unit is now available from the National

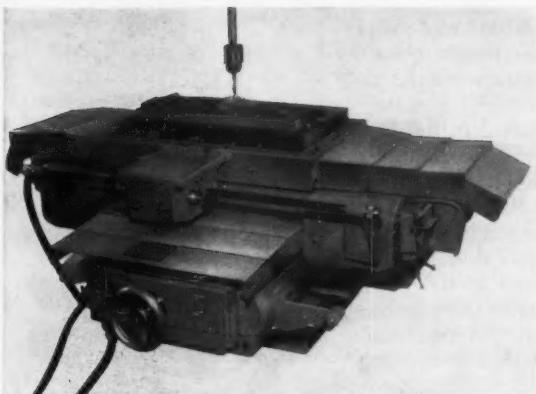
Broach & Machine Co., Detroit, Mich. The unit has a built-in electronic "ear" that automatically inspects and rejects gears. This device eliminates human sound-level appraisal errors and features a Red Ring fully automatic magazine-feed, rocker-type loader; a separate control console; and an electronic control circuit that prevents extraneous noises from causing gear rejection.

The unit illustrated can be adapted to electronically sound-test gears in the 7/8- to 3-inch diameter range. Special tooling is provided for handling different gears. All moving parts of the gear speeder unit are covered with sheet metal guards to provide maximum operator safety.

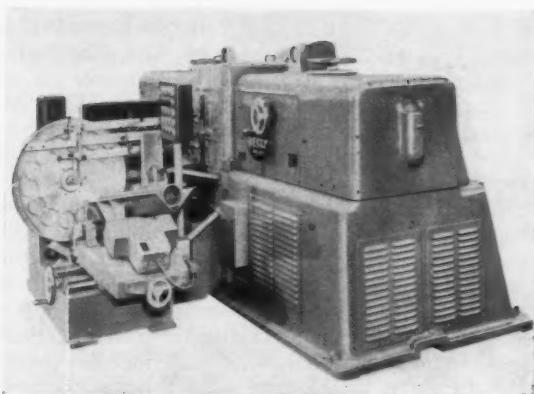
The gear being sound-tested, as well as its test mate, are rigidly mounted on arbors supported



Electronic gear sound inspection unit built by National Broach & Machine Co.



Indexing table with improved indenter mechanism announced by the Micro-Positioner Corporation



No. 240 30-inch double horizontal disc grinder announced by Besly-Welles Corporation

from both sides; stub arbor designs being avoided because of possible resulting deflection conditions. Time delay controls in the electronic amplifier circuit require that any noise signal must last for a predetermined time before the gear rejection gate solenoid is opened. Thus only sustained gear noise and not sharp extraneous sounds of short duration will operate the mechanism.

Gears are automatically loaded, run in both directions in mesh with another gear with and without brake loading, unloaded, and passed or rejected by the electronic sound discriminator unit whose microphone is placed near the gear mesh area. The sound discriminator unit may be adjusted at any time to the range of audible noise frequency and intensity desired for rejection. Pinions can be fed to the automated speeder unit from a conveyor unit or loaded manually into a magazine feed mounted on the machine.

*Circle Item 130 on postcard, page 233*

#### Indenter Mechanism for Indexing Table

The Micro-Positioner Corporation, Santa Monica, Calif., has announced two improvements in the indenter mechanism of their Micro-Positioner automatic indexing table. These improvements, designed to insure a high degree of accuracy, include: micro control knobs and locks which allow complete adjustment of the in-

dentation-sensing and tape-relocating mechanism; and an indenter safety switch that positively prevents indenting unless the tape is installed and the mechanism is in the correct indenting position.

The Micro-Positioner, a fully electric, push-button-controlled indexing table, makes possible reproduction of complex drill or tapping patterns repetitively and accurately within limits of 0.001 inch. Radial drills, milling machines, turret drills, or other machines having suitable spindles (when equipped with this automatic indexing table) become universal production machines capable of innumerable operations.

*Circle Item 131 on postcard, page 233*

controls and at-a-glance reading of head and disc alignment; sealed spindle quill construction; automatic push-button dressing; automatic sizing to adjust for disc wear; edge-grain Formica wearing ways; head assembly neoprene sealed against dust and coolant; fast magnetic rotary through feed; and easy disc removal.

*Circle Item 132 on postcard, page 233*

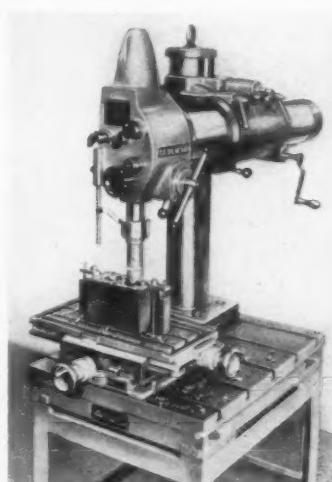
#### All-Angle Precision Boring Machine

An Oerlikon UB2, all-angle, precision boring machine, combining a radial swivelling arm with a freely swivelling head, is being introduced in this country by Olkon

#### Besly Double Horizontal Disc Grinder

A double horizontal disc-grinding machine with its spindle motors contained within a broad, low, massive, easily accessible base, and with push-button controls on both sides has been introduced by the Besly-Welles Corporation, South Beloit, Ill. It is claimed that this design has reduced the time required for maintenance, dressing, changes and setups by as much as 30 per cent. This machine is designed for accurate, high-speed precision finishing of piston-rings, bearing rings, automatic transmission plates, and similar work within parallelism limits of 0.0001 inch.

Features include: push-button



Oerlikon all-angle precision boring machine introduced by Olkon Research Corporation

Research Corporation, New York City. This machine is capable of handling a wide variety of work, including operations in the most awkward positions. It is designed to perform general workshop operations such as drilling, milling, countersinking, tapping, precision and counterboring, reaming, facing, and trepanning. The boring head can be tilted or rotated to any angle (360 degrees) and latched accurately into the vertical and horizontal positions.

A precision double-row roller bearing at the bottom of the quill ensures the accurate boring. The range of speeds (30 to 3070 R.P.M.) and three power feeds combined

with a compound table for coordinate location, make this machine suitable for toolroom work. As a portable radial drill and borer, the machine proves useful in the fitting section, or even for production work in combination with other machines, such as horizontal boring and milling machines.

The self-contained drilling and boring unit, as well as the precision compound table can also be used independently. Accessories include: precision chuck, tapping heads, collet holder, adjustable boring head, facing and turning head-trepanning tool, and boring-bars.

*Circle Item 133 on postcard, page 233*

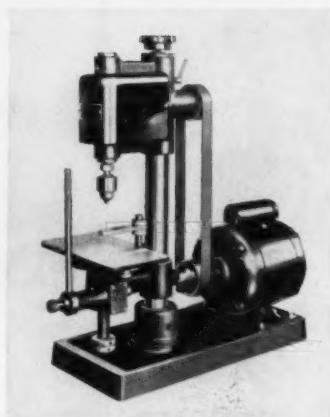
#### Maserati Horizontal and Vertical Milling Machines

The Maserati Corporation of America, Westbury, Long Island, N. Y., has announced the addition of a Model No. 3 to its line of horizontal and vertical milling machines introduced in this country. These machines, built in Italy by the Maserati Machine Works, are designed and calibrated specifically for the American market.

The Model No. 3 machines have a table working surface 59 by 13 25/32 inches with three table

slots, each 0.7086 inch wide. The distance between slots is 3.1495 inches. Table swivel (universal) is 45 degrees, and the maximum distance from center of spindle to top of table is 18 1/4 inches. These machines feature power rapid traverses in all directions, dual automatic selection of speeds and feeds, dual controls for all power feeds and rapid traverses, and dual controls for clutch and brake.

*Circle Item 134 on postcard, page 233*



Hamilton precision tapping machine

#### Spindle Return Device for Precision Tapper

Design of the precision tapping machine made by the Hamilton Tool Co., Hamilton, Ohio, has been improved by a simple "hom-ing" device. This device returns the tapping machine spindle to neutral position instantly and automatically when pressure on the feed-lever is released. Rotation stops, and the tap can be withdrawn through reverse pressure on the feed-lever.

This feature permits precision tapping of thin sheets without the

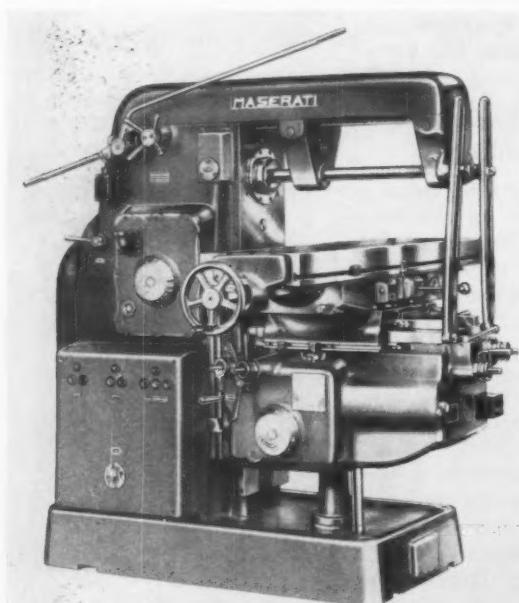


Fig. 1. Maserati horizontal milling machine

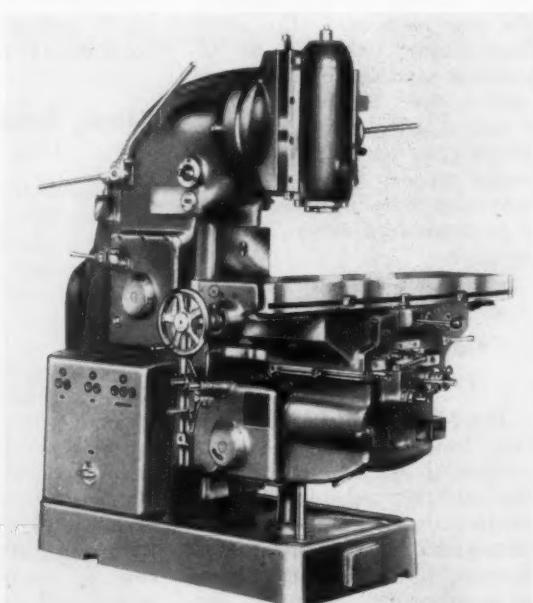


Fig. 2. Maserati vertical type milling machine

risk of stripping, and of brittle plastics without chipping. Also, blind holes can be tapped to the bottom without tool breakage. The homing device extends the capacity of the machine for tapping holes from as small and fine as 0.034-120 threads to as large and coarse as 0.25-24 threads.

Circle Item 135 on postcard, page 233

### Double Miter Cut-Off Saw

A new type of double miter cut-off saw, called the Model DMS-400, has been announced by the Queens Tool Mfg. Co., Rockville Centre, Long Island, N. Y. Although designed to meet the specific needs of the aluminum door and window industry, this high-precision machine is readily adaptable to many other metal- and plastic-cutting operations.

The machine is 56 inches high and has an adjustable work-table, 42 inches high. The blades are 12 inches in diameter and are powered by two 2-H.P. motors with twin-belt transmission. Operation is by pneumatic foot control. The standard cut-off length is 72 inches, but this can be varied to suit requirements.

Circle Item 136 on postcard, page 233

### Carmet Tool-Holders for Throw-Away Blanks

A line of tool-holders for use with throw-away type cemented tungsten carbide blanks has been announced by the Carmet Division of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. These holders are intended for use with carbide throw-away blanks in the machining of metal and other materials. The small carbide blanks used in the holders are designed with a large number of sharp cutting edges or surfaces. The blanks can be easily indexed to obtain a new cutting surface.

The tool-holders are available in more than ninety styles and sizes. They are equipped with a gripping design in which the cutting pressure is exerted in the same direction as the pressure developed by the clamping screw. The clamping screw has recessed heads at both ends which are accessible from both the top and bottom of the holder. This arrangement is advantageous when using a rear tool carriage. The tool-holders are cadmium plated to resist corrosion and have replaceable carbide chip-breakers.

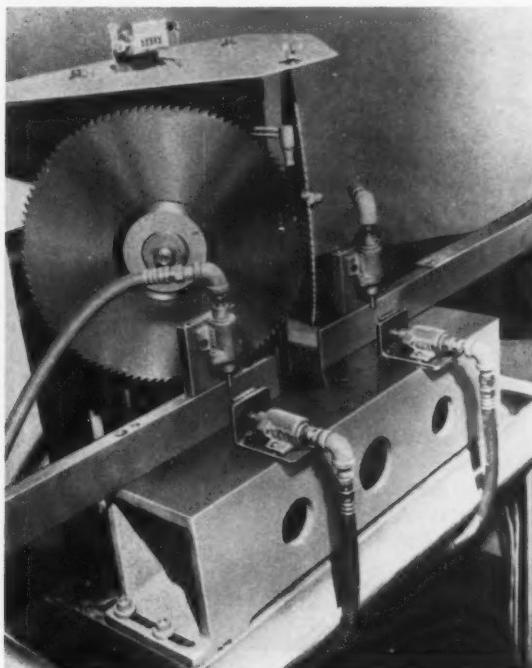
Circle Item 137 on postcard, page 233



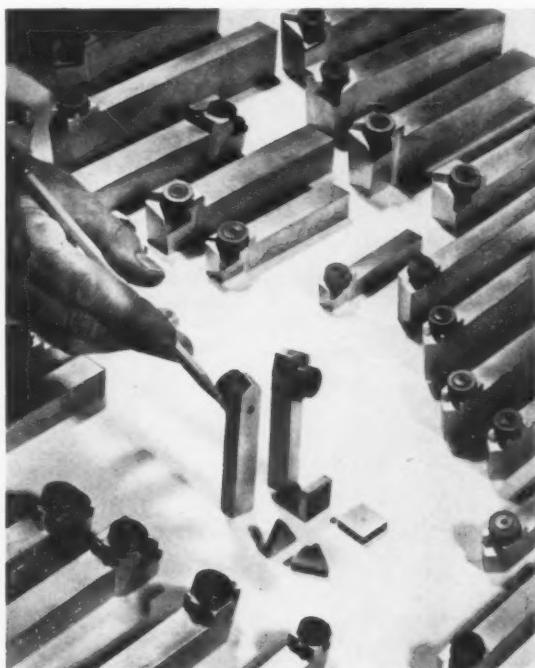
Compact sander developed by Pneumatic Division, Sundstrand Machine Tool Co.

### Lightweight Orbital Sander

A Model 800 orbital sander weighing only 3 pounds, which fits readily into the palm of the hand, is announced by the Pneumatic Division, Sundstrand Machine Tool Co., Rockford, Ill. This high-speed unit operates on 6000 cycles at an air pressure of 40 pounds per square inch for fast removal of material. Air consumption, ranging from 5 to 7 cubic feet per minute, is extremely low for a unit having the work capacity claimed for this sander. Palm lever control



Queens double miter cut-off saw



Carmet tool-holders and throw-away blanks

facilitates sanding in restricted areas and right up to moldings.

The sander can be used for wet sanding if a separate supply of water is provided. It takes a 3-by 8-inch sheet of sandpaper which is secured by an exceptionally sturdy, quick-acting clip. The rubber boot shown in the illustration serves as a dust shield only and is not used to control the sander.

Circle Item 138 on postcard, page 233

### Govro-Nelson Drilling, Tapping, Reaming, Slotting, and Deburring Machine

A machine developed by the Govro-Nelson Co., Detroit, Mich., for processing a steel automotive part incorporates five automatic drilling units, together with a power saw. The machine drills, taps, taper reams, slots, and deburrs the automotive part in the order stated, performing the six operations on 700 parts per hour—a task that would ordinarily require six men and six machines.

The operator merely clamps the part in the machine. All operations, as well as clamping and

ejecting, are then performed automatically. The machine can be readily adapted to a variety of operations by changing the arrangement of the drilling units.

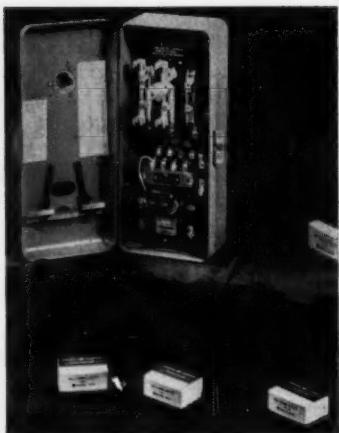
Circle Item 139 on postcard, page 233

### Power-Driven Straightener for Coiled Stock

The U. S. Tool Company, Inc., Ampere (East Orange), N. J., has added to its line of automatic pressroom equipment a Model PDS-4 1/2 power-driven straightener. This straightener is designed to handle material up to 4 1/2 inches wide by 1/8 inch thick. It is equipped with a pair of power-driven take-in rolls and six straightening rolls (upper three individually adjustable and lower three power-driven).

Hinged construction permits the straightener to be opened for easy threading of the end of a new coil. The straightener is furnished with forward, stop, and reverse controls, indicators on straightening rolls, micro-switch loop control arrangement, and 1/2-H.P. variable-speed drive motor.

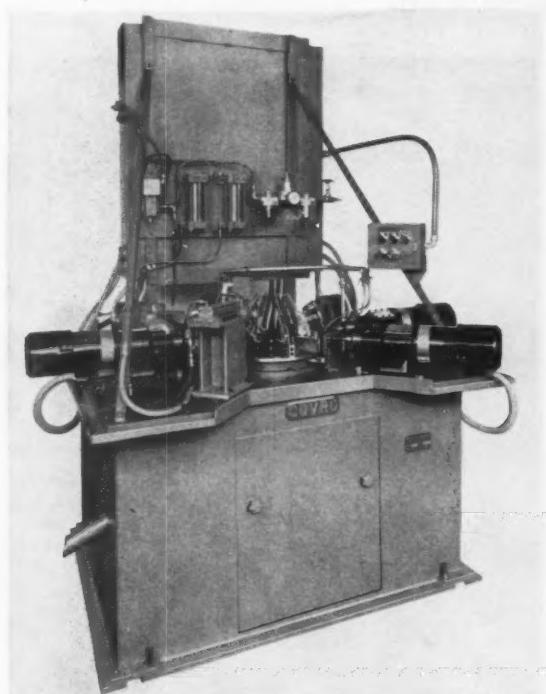
Circle Item 140 on postcard, page 233



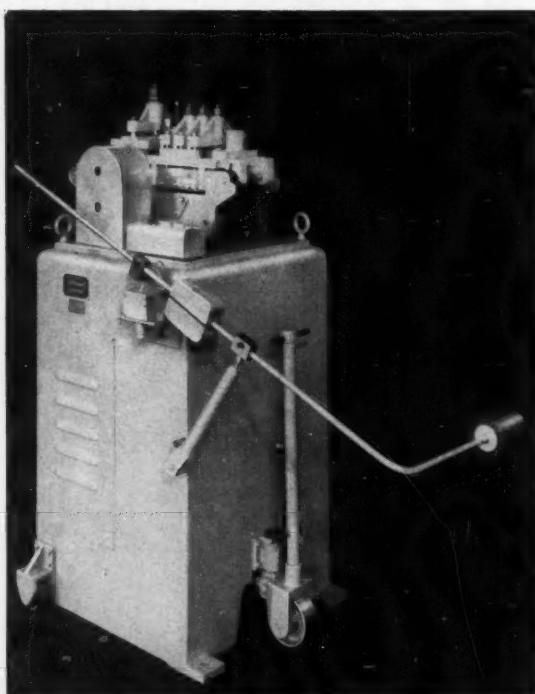
General Electric Co.'s modification kits for magnetic starters

### Kits for Modification of G-E Magnetic Starters

Six kits for on-the-spot modification of magnetic starters made by the General Electric Co., Schenectady, N. Y., are available from the company's General Purpose Control Department. Built for across-the-line, nonreversing, combination, or reversing starters, the six different kits permit modifications



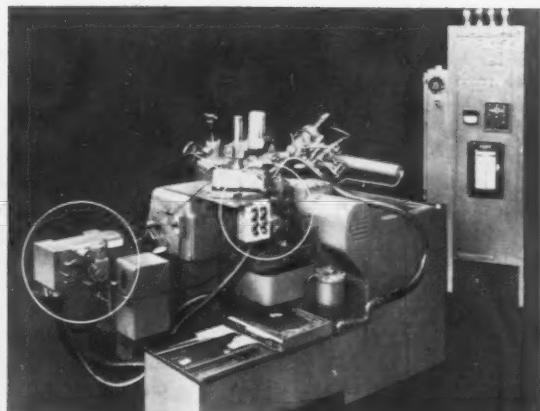
Machine built by the Govro-Nelson Co. for processing automobile part



Coiled stock straightener brought out by the U. S. Tool Company, Inc.



Multi-channel, direct-current amplifier unit made by the Brush Electronics Co.



Centerless grinder equipped with Kaydon Size-O-Tron automatic gaging and feeding system.

to be made in a matter of minutes using only a screwdriver.

The standard General Electric magnetic starter may be modified to fit any of six special conditions by installing a push-button or selector switch in the starter cover, changing fuse clips on the disconnect switch, changing the coil, adding a third overload relay, or adding an auxiliary interlock kit. These modifications are for starters in open or in NEMA Type 1 enclosures and for NEMA sizes from 0 to 4.

To meet different line current or voltage requirements, fuse-clip kits are available for modification of combination starters. These kits come in ratings from 30 to 400 amperes at 250 or 600 volts. When a third overload relay is necessary, on-the-spot addition to starters can be easily accomplished. All General Electric magnetic starters are furnished with two bi-metallic overload relays. Strongbox kits enable coils of all starters to be used for different voltage ratings.

Circle Item 141 on postcard, page 233

### Brush Multi-Channel Amplifier Unit

A multi-channel, direct-current amplifier unit for use where maximum mobility and flexibility are desired has been developed by the Brush Electronics Co., Cleveland, Ohio. This unit, known as Model BL-536, is mounted on a bench-top console only 29 1/2 inches high. It consists of six completely

interchangeable plug-in, direct-current amplifier sections, plus power supply, and a six-channel oscilloscope.

In addition to its operating flexibility, the amplifier unit features a measurement range from 0.050 to 400 volts; has excellent zero line stability; and a unique internal calibration system. The plug-in amplifier sections provide for expanding the system as desired up to the six-channel operation. Accompanying oscilloscopes offer a wide range of chart speeds and a choice of ink or electric writing.

Circle Item 142 on postcard, page 233

### Jig Borer Chuck Set

A chuck set which will bore any size hole from 5/32 inch to 5 inches has been introduced by the Moore Special Tool Co., Inc., Bridgeport, Conn., for use with its jig borer. By means of a reducer bushing, it is possible to use either 1/2- or 3/8-inch shank tool bits. Cutters are available in either high-speed steel or carbide.

The boring chuck is hardened and ground and can be adjusted behind center for starting small holes. The slide can be unclamped, moved, and reclamped in exacting increments. One wrench fits all screws. Appropriate shank adapters, also newly available, permit use of this boring chuck set with all machines having No. 40 tapers and with all Bridgeport millers.

Circle Item 143 on postcard, page 233

### Kaydon Size-O-Tron Gage and Feed System for Centerless Grinders

The Kaydon Engineering Corporation, Muskegon, Mich., has announced an electronic automatic gage and feed system for through-feed centerless grinders. This automatic mechanism, named Size-O-Tron, utilizes the feedback principle as it automatically gages the parts being ground, adjusts the grinder to compensate for wheel wear, and records the size. The finished work is continuously gaged as it emerges from the machine, and the information from the gaging unit is fed back to the machine, automatically making adjustments for wheel wear and all other variables that effect size changes.

With this control system, one



Jig borer chuck set introduced by the Moore Special Tool Co., Inc.

operator can run several machines operating at full speed, virtually eliminating manual gaging. It is also claimed that the control permits machines to be run as much as 50 per cent faster, restricts scrap loss to setup pieces, and insures grinding all parts uniformly.

In actual operation, the Size-O-Tron attached to a conventional centerless grinder is capable of maintaining a tolerance or spread of 0.000050 inch, disregarding the inherent inaccuracies of the machine. If the variation within the machine does not exceed 0.000050 inch, a total tolerance of 0.0001 inch can be maintained.

Circle Item 144 on postcard, page 233

### Geometric Convertible Self-Opening Die-Head

A Model DSA Geometric die-head is being introduced by the Geometric Tool Co., Division of Greenfield Tap & Die Corporation, New Haven, Conn. This convertible, self-opening die-head with aligning shank is intended primarily for use on Brown & Sharpe and other small screw machines of either the automatic or hand type. It is equipped with both an outside trip for short length, fine-pitch shoulder threading and a pull-off trip for longer threads, providing ample chaser engagement for tripping. Conversion from one type trip to the other is easily and quickly accomplished.

Improvements claimed for the DSA die-head include: easier assembling and disassembling; driving construction that provides for



Geometric die-head of improved design with convertible trip

freer and smoother operation; tongue and groove drive between cam spring plate and skeleton; more rugged construction of small parts—new and heavier stop plunger, larger adjusting screws (hollow hexagonal); heavier tripping mechanism; larger cam spring plate screws—without increase in size or weight of die-head; flattened construction of back-part and shank (permitting the die-head to be installed as close to the turret as possible without interference); and better interchangeability of parts, including interchangeable chasers.

Circle Item 145 on postcard, page 233

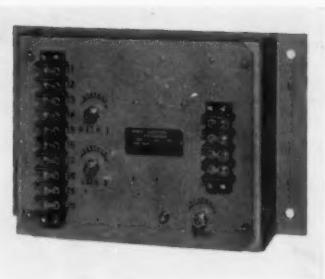


Fig. 1. Transistorized servo amplifier made by Minneapolis-Honeywell

### Electro-Hydraulic Machine Controls

A transistorized servo amplifier, Fig. 1, and an electro-hydraulic servo valve, Fig. 2, which make possible electro-hydraulic control of industrial machinery, have been developed by the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. These two components were designed to combine the best features of electronic signal sensing with hydraulic control of variable delivery pumps, hydraulic motors, cylinders, and similar equipment. The amplifier, XJR301A, and the electro-hydraulic servo valve, XVJ300A, make it possible to apply hydraulic power control to many mechanisms previously limited to electric drives. They also provide precision control of existing hydraulic equipment which could not previously be controlled automatically.

With these units, linear motion control can be applied to hydraulic presses, reciprocating drives used in planers, grinders, or saw mill carriages, and in a wide variety of straight-line positioning applica-



Solenoid-operated valve announced by Skinner Chuck Co.

### Solenoid-Operated Valve

A low-cost solenoid valve designed for control of air, water, oils, gasoline, and many other fluids and gases is announced by the Skinner Electric Valve Division of the Skinner Chuck Co., New Britain, Conn. This C series, compact, brass-bodied valve weighs only 12 ounces. It is a packless, direct-acting type valve, with only two moving parts and is threaded for 1/8-inch pipe. Positive closing is assured by a spring return.

The valve orifices range from 5/32 to 7/64 inch, with pressures ranging from 60 to 130 pounds per square inch. Typical applications include: automotive fuel systems; welding equipment; vending machines; lubricating devices and systems; instruments; and automated machine controls.

Circle Item 146 on postcard, page 233



Fig. 2. Minneapolis-Honeywell electro-hydraulic servo valve

tions. Rotary motion applications include lead-screw feeds, spindle drives, and processing machinery which requires precise control of shaft rotation. Control combinations possible with the new electro-hydraulic servo "team" include stroke control feed-back, pressure or flow feed-back, and feed-back of load position, velocity, force, torque, etc.

**Circle Item 147 on postcard, page 233**

### Flat-Twisted and Rolled-Section Drills

The Hi-Duty Drill Works, Fleetwood, Pa., manufacture flat-twisted and rolled-section drills in sizes ranging from 1/2 inch to 3 1/4 inches in diameter, and larger. Milled type drills are made



Three-step drill made by the  
Hi-Duty Drill Works

in sizes from 1/64 to 1/2 inch in diameter, and in a great variety of special types and lengths. One of the latest developments in this line of drills is the three-step 1 7/8-inch diameter drill illustrated. Other step drills are made in sizes ranging from 0.190 inch to 5 inches in diameter and lengths up to 40 inches.

**Circle Item 148 on postcard, page 233**

### Brakemotor Designed to Instantly Stop and Hold Heavy Loads

Reliance Electric & Engineering Co., Cleveland, Ohio, has introduced a line of rugged, cast-iron brakemotors built to instantly stop and hold heavy loads. Advanced design and totally protected components have been combined in these motors to assure long life and trouble-free operation on all types of equipment from bottle-washing machinery to heavy-duty cranes.

Features include a torque range

from 3 pound-feet to 345 pound-feet, one-piece molded friction linings for quick stops, and one-operation torque setting. In the event of power failure or low voltage, "dead man" operation sets and holds the load until normal operation is restored.

The design incorporates a minimum of wearing parts, and any adjustments may be made easily



Reliance brakemotor

with ordinary tools by simply removing the brake housing and lifting out the entire operating mechanism. All types of enclosures are available including those suitable for outdoor installation or where extremely moist, corrosive, or abrasive dust conditions exist.

**Circle Item 149 on postcard, page 233**



Johansson "Thrift" blocks announced by the Brown & Sharpe Mfg. Co.

shop measurements. Set No. 1 consists of eighty-four blocks which, in combination, will produce a half million different gage sizes. Set No. 2 includes thirty-six blocks which will produce over 150,000 different gage sizes. Each set is furnished in an attractive wood case, with spaces provided for wear blocks, also a chamois cloth for wiping the blocks prior to use. "Thrift" blocks may be purchased individually when desired, and chromium carbide wear blocks are available.

**Circle Item 150 on postcard, page 233**

### Pratt & Whitney Screw Machine Tap

The Brown & Sharpe Mfg. Co., Providence, R. I., has announced its new Johansson "Thrift" blocks developed for on-the-job use. These blocks have an accuracy and parallelism of plus or minus 0.000008 inch with a surface finish maintained from 1.0 to 1.5 micro-inches. The flatness is held within 0.000006 inch. These new blocks are economy priced and give Class B block accuracy.

Two sets of blocks are available which cover the great majority of

A stub tap designed and manufactured specifically for use in screw machines has been announced by the Pratt & Whitney Co., Inc., West Hartford, Conn. Shorter in length than a conventional tap, this new tool incorporates features which are said to eliminate most tapping difficulties encountered when using ordinary taps for screw machine operations.

The most notable features of the tap are: a necked shank for generous lubrication; a spiral point to

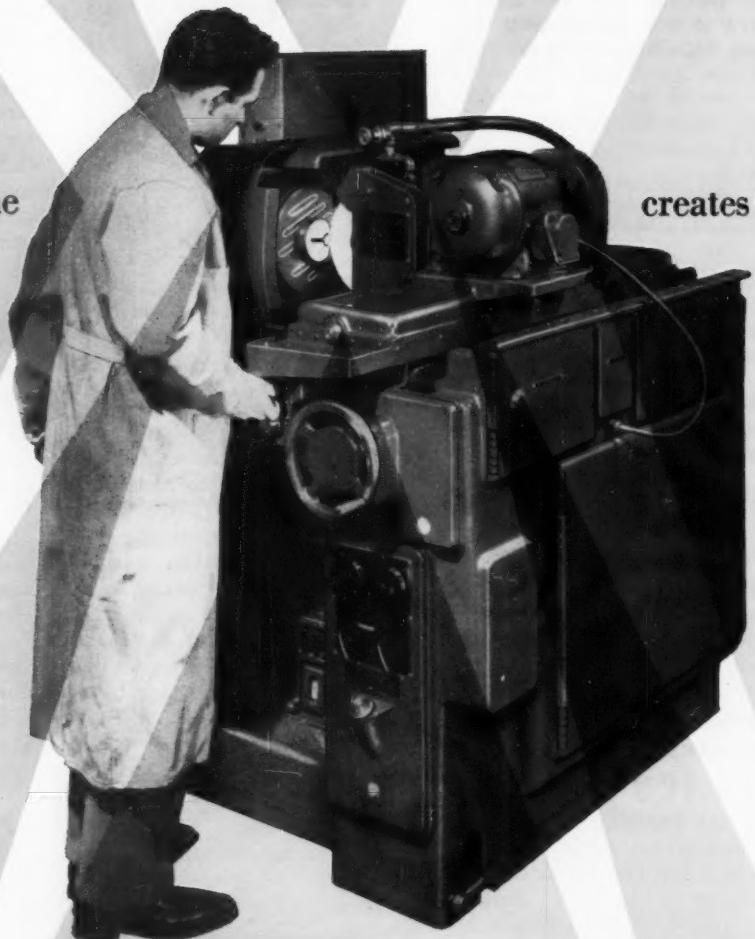
(Continued on page 212)



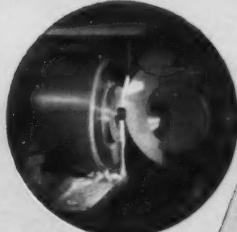
Stub tap for screw machines announced by the Pratt & Whitney Co., Inc.

this advanced machine

creates . . .



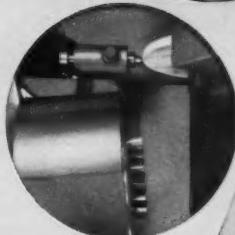
The Brown & Sharpe No. 11 Face Grinding Machine



**Exclusive Horizontal Work Spindle**  
Aids coolant in flushing work —  
assures finer quality surfaces.  
Provides a natural loading position  
for automated lines.



**Exclusive Lever Control of Work Holders**  
Permits speedy chucking,  
minimizes loading time. Work-  
holding by either permanent  
magnet chuck or face chuck.



**Exclusive Set-Diamond Dressing**  
Eliminates need to re-establish  
wheel position after each dressing.  
Available as an automatic feature  
for top economy of wheels and diamonds  
— positive protection for size.

## New Possibilities in Face Grinding!



**Automatic Cycle and Spark-Timing**  
An "optional" that makes  
operation completely automatic —  
assures repeat accuracy.

*greater accuracy  
greater versatility  
greater economy*

Now there's a truly advanced face grinding machine that lends itself perfectly to **any** loading technique — manual or automatic! It's the new Brown & Sharpe No. 11 Face Grinding Machine . . . unmatched for precise, efficient, economical grinding of flat, concave, and convex work up to 10" diameter and 4 $\frac{3}{4}$ " thickness. Four of its outstanding design features are illustrated on these pages. There are *many* more — advantages that make it the most valuable face grinder available for either toolroom work or high production. Write for complete details.

Brown & Sharpe Mfg. Co.,  
Providence, Rhode Island.



Ask About Our Pay-as-You-Depreciate  
Machine Tool Plan

**Brown & Sharpe**

reduce torque and improve chip disposal; and a short thread length to counteract the tendency to produce bellmouth threaded holes because of misalignment. Stub taps have been tested in the field over a three-year period and are said to have given excellent performance. They are available from stock in high-speed steel with NC or NF ground threads, and plug or bottoming chamfer, in Nos. 2 to 10 machine screw sizes, made to GH2 limits.

**Circle Item 151 on postcard, page 233**

### Special Thrust Bearing for Pay-Off Reel Yoke

A heavy-duty, single-acting thrust bearing, having a load capacity of 116,000 pounds at 200 R.P.M.; 76,500 pounds at 700 R.P.M.; and 67,800 pounds at 1000 R.P.M., has been designed by the Rollway Bearing Co., Syracuse, N. Y., for applications such as

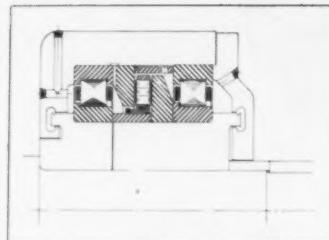


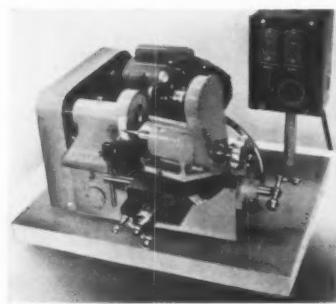
Diagram of thrust bearing designed by the Rollway Bearing Co.

payoff reels. The high-grade alloy steel thrust plates used with these bearings are made extra thick (1 1/4 inches) to insure high load capacity and extend bearing life. The plates are held to extremely close accuracy limits for parallelism and maximum linear contact. Special plates shown above the thrust bearing in the accompanying illustration are designed to relieve the inner race of the radial bearing shown at left and the outer race of the radial bearing

seen on the right. The thrust load is carried at right angles to the roll axis on ninety short, cylindrical rollers. Rollers are staggered to equalize distribution of wear. The inner spacer sleeve on shaft and outer sleeve in housing provide "operating float."

Completing the bearing assembly are two Rollway radial roller bearings. In the application illustrated, the Type MUL bearings have a load capacity of 72,000 pounds at 200 R.P.M.; 47,500 pounds at 700 R.P.M. and 42,100 pounds at 1000 R.P.M. The bearings have a single-flange separable inner race and the roller assembly is self-contained in the double-flanged outer race. These flanged radial bearings are recommended because of their comparatively large thrust capacity, which permits them to take reverse locating thrust. Load rating of this size MUL bearing, for example, is 28,000 pounds at 100 R.P.M.

**Circle Item 152 on postcard, page 233**



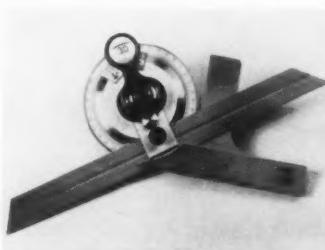
### Precision Pin and Small Parts Grinder

The Dykrex Corporation, Newark, N. J., has started production of a low-cost precision pin grinder. This machine is especially adapted for grinding the pins used in lapping wire-drawing dies but can also be used to grind a large variety of special parts with tapers or points having any desired included angle up to 90 degrees.

**Circle Item 153 on postcard, page 233**

minutes of arc announced by the George Scherr Co., New York City. The special chrome-steel blade is hardened and has clearly defined graduation lines. It is also available in stainless steel throughout for complete protection against rust and corrosion. To make reading even easier, the protractor can be furnished with an adjustable magnifier mounted over the scales, as shown in the illustration. The tool is regularly equipped with a 6-inch blade; acute angle attachments for measuring small angles; and a stand with precision lapped base which can be set up on shafts, as well as on flat surfaces. A 12-inch blade is available as optional equipment.

**Circle Item 154 on postcard, page 233**



### Universal Bevel Protractor

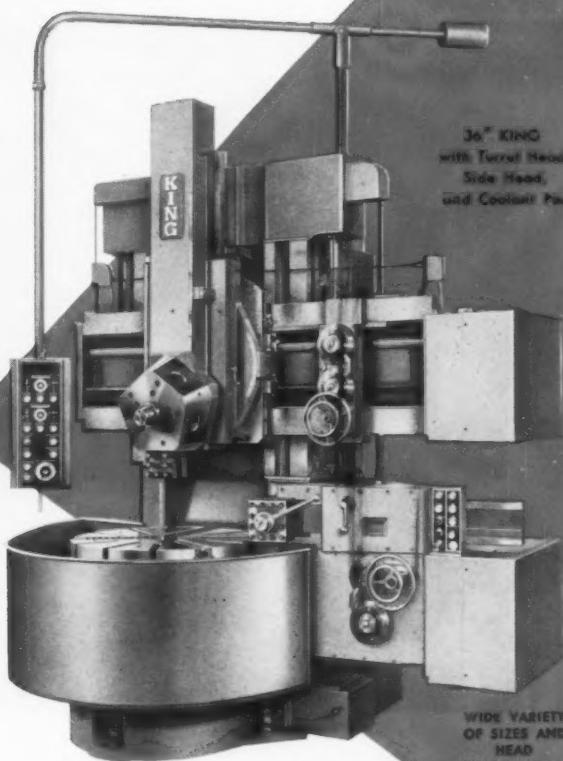
Universal bevel protractor with "Lustro-Chrome" finished measuring face and vernier reading to 5



### Jergens Speed Bar Knobs

Speed bar knobs, manufactured by Jergens Tool Specialty Co., Cleveland, Ohio. These four-pronged knobs are said to offer many advantages over the conventional cranks and handles ordinarily used on machines, jigs, and fixtures. The knobs are made of durable malleable iron throughout and are easily turned by hand or with a bar or tool handle inserted between the prongs. Four models have an extra-long prong for use with a crank handle. The complete range of fifteen models provides sizes for almost every re-

(Continued on page 218)



36" KING  
with Turret Head,  
Side Head,  
and Coolant Pump

WIDE VARIETY  
OF SIZES AND  
HEAD  
COMBINATIONS

## Complete Electrical Controls on the all new **KING** speed set-up and production time

### ALL CONTROLS CONVENIENT TO OPERATOR

#### LOCATED ON PENDANT—

Feed and rapid traverse movements  
— and —

Pre-selective feed selection  
from direct-reading dials:

for rail heads on machines with  
two heads on rail . . . for rail head  
and side head on machines with  
one head on rail.

Power swiveling of rail heads

Pre-selective speed selection from  
direct-reading dial

Speed change • Turret index • Table stop

#### LOCATED ON SIDE HEAD PANEL—

Feed and rapid traverse movements of side head  
— and —

Pre-selective side head feed selection  
from direct-reading dial:  
on machines with two heads on rail.

Main drive • Rail positioning • Coolant pump

Thread cutting and taper turning  
selection for all heads

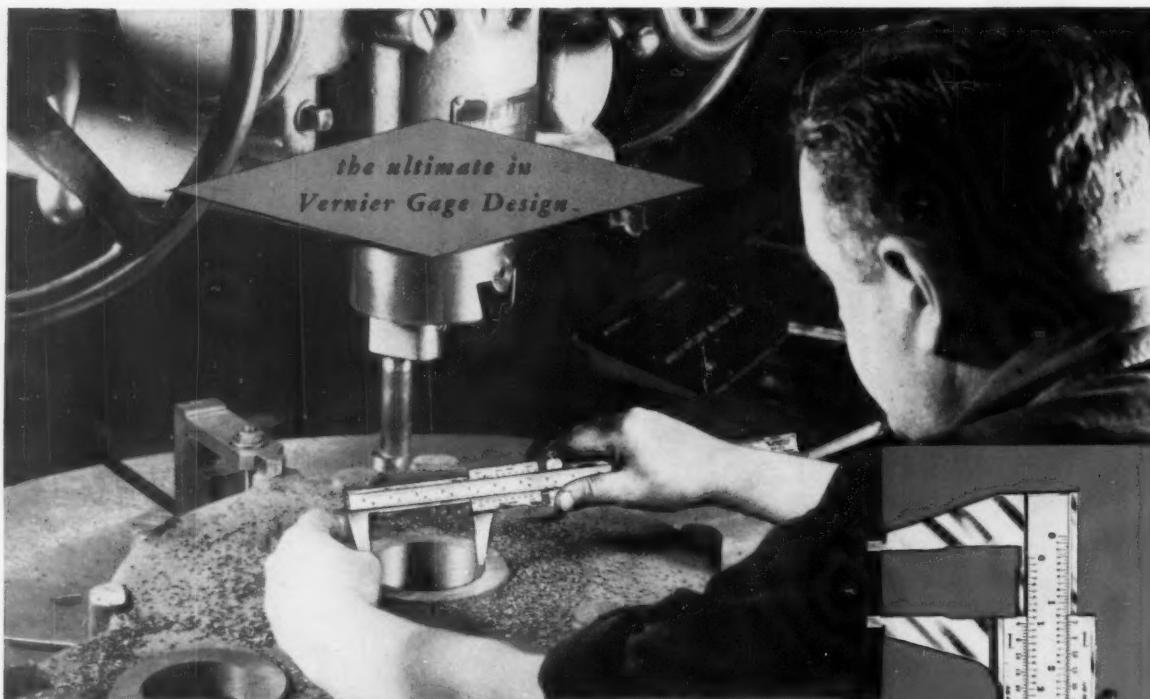
New KING® Vertical Boring & Turning Machines incorporate highly advanced, complete electrical controls to give you faster production at lower costs. Controls, listed at left, are conveniently located on movable pendant station and fixed side head panel.

Controls are not the whole story, of course—the All New KING has many other important production-boosting features. Horsepower has been increased to 40 to 50 H. P. on 30", 36", and 46" sizes; 75 to 100 H. P. on sizes 56" and up. Spindle drive provides 24 speeds in any one of three standard ranges: high, intermediate, or low. 24 feeds from .0016" to .250" per revolution are available. Complete drive transmission is mounted in an extra-rugged housing, assuring increased stability. Entire drive is removable as a unit.

Among other outstanding features are . . . new spindle and spindle mounting providing maximum table stability . . . automatic lubrication of all moving parts . . . anti-backlash nuts for all cross-feed movements. Machine is adapted for simple optional addition of: automatic positioning of heads, automatic tracing control of heads, automatic cycling, power rail clamping, power indexing of turrets. For full details see your authorized King Distributor, or write us direct.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION  
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

**KING** Vertical Boring and Turning Machines



## New **Starrett®** No. 123 *Satin Chrome* **MASTER-VERNIER CALIPER**

Here is a new Vernier caliper that can be used with supreme confidence in its master precision... a gage with Starrett no-glare *Satin Chrome Finish* for easy reading and rust and stain resistance... with new, long 50-division Vernier scales for simplified setting and error-proof reading without a magnifying glass... with new flush fitting Vernier scales to eliminate parallax errors... with new open-face design which provides both inside and outside Vernier scales on the same side of the tool — you hold and read it exactly the same for all measurements.

If you take pride in the precision standards of your shop, you'll want the new Starrett No. 123 MASTER-VERNIER Caliper... for its positive precision, error-proof design and lifetime accuracy.

Your Industrial Supply Distributor will gladly demonstrate its many outstanding new features... or send for descriptive folder.

### NO OTHER VERNIER GAGE GIVES YOU ALL THESE STARRETT FEATURES

**SATIN CHROME FINISH** — no-glare, easy reading, long wearing, rust and stain resisting.

**NEW LONG VERNIERS** with widely spaced graduations for easy setting and reading.

**FLUSH FITTING VERNIER PLATES** to eliminate optical reading errors.

**OPEN-FACE DESIGN** with inside and outside scales on the same side — no need to turn the tool.

**HARDEDENED, STABILIZED** master bar for maximum rigidity, resistance to wear, lasting accuracy.

**EXTRA LONG ADJUSTING JAW** for greater bearing surface to assure perfect squareness.

**NEW JAW DESIGN** for greater rigidity and resistance to springing.

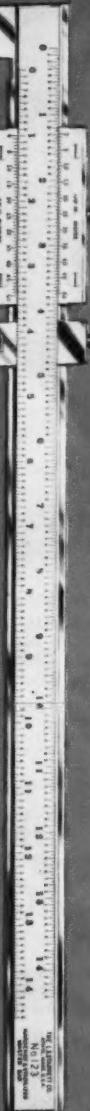
**12- AND 24-INCH SIZES** graduated in thousandths to read the full 12- or 24-inch length.

### BIG NEW CATALOG NO. 27

Describes and illustrates the complete Starrett line. Ask your Industrial Supply Distributor or write for free copy. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

**Starrett**  
SINCE 1880  
WORLD'S GREATEST TOOLMAKERS

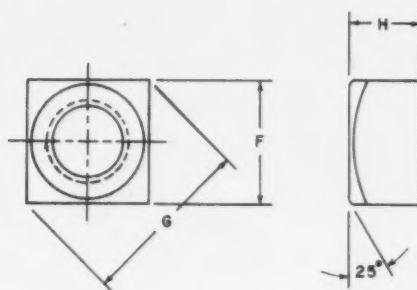
HAND MEASURING TOOLS AND PRECISION INSTRUMENTS  
LINE INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK  
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES



For more information fill in page number on Inquiry Card, on page 233

# MACHINERY'S DATA SHEET

## AMERICAN STANDARD REGULAR SQUARE NUTS



| Nominal Size or Basic Major Diameter of Thread | Width Across Flats F |       | Width Across Corners G |       | Thickness H |       |       |
|--|----------------------|-------|------------------------|-------|-------------|-------|-------|
|  | Max. (Basic)         | Min.  | Max.                   | Min.  | Nom.        | Max.  | Min.  |
| 1/4 0.2500                                     | 7/16 0.4375          | 0.425 | 0.619                  | 0.584 | 7/32        | 0.235 | 0.203 |
| 5/16 0.3125                                    | 9/16 0.5625          | 0.547 | 0.795                  | 0.751 | 17/64       | 0.283 | 0.249 |
| 3/8 0.3750                                     | 5/8 0.6250           | 0.606 | 0.884                  | 0.832 | 21/64       | 0.346 | 0.310 |
| 7/16 0.4375                                    | 3/4 0.7500           | 0.728 | 1.061                  | 1.000 | 3/8         | 0.394 | 0.356 |
| 1/2 0.5000                                     | 13/16 0.8125         | 0.788 | 1.149                  | 1.082 | 7/16        | 0.458 | 0.418 |
| 5/8 0.6250                                     | 1 1.0000             | 0.969 | 1.414                  | 1.330 | 35/64       | 0.569 | 0.525 |
| 3/4 0.7500                                     | 1 1/8 1.1250         | 1.088 | 1.591                  | 1.494 | 21/32       | 0.680 | 0.632 |
| 7/8 0.8750                                     | 1 5/16 1.3125        | 1.269 | 1.856                  | 1.742 | 49/64       | 0.792 | 0.740 |
| 1 1.0000                                       | 1 1/2 1.5000         | 1.450 | 2.121                  | 1.991 | 7/8         | 0.903 | 0.847 |
| 1 1/8 1.1250                                   | 1 11/16 1.6875       | 1.631 | 2.386                  | 2.239 | 1           | 1.030 | 0.970 |
| 1 1/4 1.2500                                   | 1 7/8 1.8750         | 1.812 | 2.652                  | 2.489 | 1 3/32      | 1.126 | 1.062 |
| 1 3/8 1.3750                                   | 2 1/16 2.0625        | 1.994 | 2.917                  | 2.738 | 1 13/64     | 1.237 | 1.169 |
| 1 1/2 1.5000                                   | 2 1/4 2.2500         | 2.175 | 3.182                  | 2.986 | 1 5/16      | 1.348 | 1.276 |

All dimensions given in inches.

Regular square nuts are not finished on any surface but are threaded.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered or washer-crowned. Diameter of the top circle shall be the maximum width across the flats within a tolerance of minus 15 per cent.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 3 degrees for 1-inch nuts or smaller, and 2 degrees for nuts larger than 1 inch.

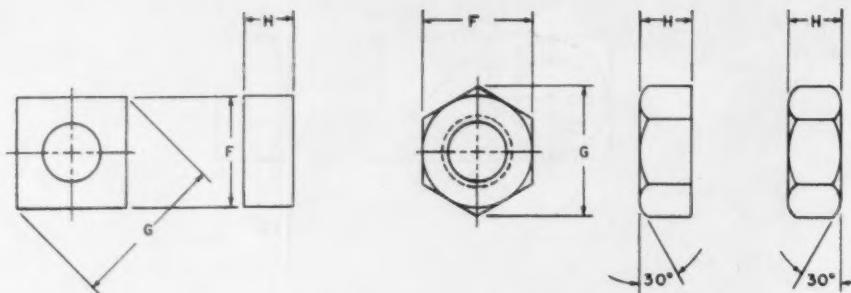
Threads for these nuts shall be coarse-thread series, Class 2B.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

# MACHINERY'S DATA SHEET

## AMERICAN STANDARD MACHINE-SCREW AND STOVE-BOLT NUTS



| Nominal Size or Basic Major Diameter of Thread | Width Across Flats F |        | Width Across Corners G |       |       |       | Thickness H |      |       |       |
|--|----------------------|--------|------------------------|-------|-------|-------|-------------|------|-------|-------|
|  | Maximum (Basic)      | Min.   | Square                 |       | Hex.  |       | Nominal     | Max. | Min.  |       |
|  |                      |        | Max.                   | Min.  | Max.  | Min.  |             |      |       |       |
| No. 0 0.0600                                   | 5/32                 | 0.1562 | 0.150                  | 0.221 | 0.206 | 0.180 | 0.171       | 3/64 | 0.050 | 0.043 |
| No. 1 0.0730                                   | 5/32                 | 0.1562 | 0.150                  | 0.221 | 0.206 | 0.180 | 0.171       | 3/64 | 0.050 | 0.043 |
| No. 2 0.0860                                   | 3/16                 | 0.1875 | 0.180                  | 0.265 | 0.247 | 0.217 | 0.205       | 1/16 | 0.066 | 0.057 |
| No. 3 0.0990                                   | 3/16                 | 0.1875 | 0.180                  | 0.265 | 0.247 | 0.217 | 0.205       | 1/16 | 0.066 | 0.057 |
| No. 4 0.1120                                   | 1/4                  | 0.2500 | 0.241                  | 0.354 | 0.331 | 0.289 | 0.275       | 3/32 | 0.098 | 0.087 |
| No. 5 0.1250                                   | 5/16                 | 0.3125 | 0.302                  | 0.442 | 0.415 | 0.361 | 0.344       | 7/64 | 0.114 | 0.102 |
| No. 6 0.1380                                   | 5/16                 | 0.3125 | 0.302                  | 0.442 | 0.415 | 0.361 | 0.344       | 7/64 | 0.114 | 0.102 |
| No. 8 0.1640                                   | 11/32                | 0.3438 | 0.332                  | 0.486 | 0.456 | 0.397 | 0.378       | 1/8  | 0.130 | 0.117 |
| No. 10 0.1900                                  | 3/8                  | 0.3750 | 0.362                  | 0.530 | 0.497 | 0.433 | 0.413       | 1/8  | 0.130 | 0.117 |
| No. 12 0.2160                                  | 7/16                 | 0.4375 | 0.423                  | 0.619 | 0.581 | 0.505 | 0.482       | 5/32 | 0.161 | 0.148 |
| 1/4 0.2500                                     | 7/16                 | 0.4375 | 0.423                  | 0.619 | 0.581 | 0.505 | 0.482       | 3/16 | 0.193 | 0.178 |
| 5/16 0.3125                                    | 9/16                 | 0.5625 | 0.545                  | 0.795 | 0.748 | 0.650 | 0.621       | 7/32 | 0.225 | 0.208 |
| 3/8 0.3750                                     | 5/8                  | 0.6250 | 0.607                  | 0.884 | 0.833 | 0.722 | 0.692       | 1/4  | 0.257 | 0.239 |

All dimensions given in inches.

Hexagon machine-screw nuts shall have tops flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent. Bottoms are flat but for special purposes may be chamfered or washer-faced if so specified.

Square machine-screw nuts and stove-bolt nuts shall have tops and bottoms flat without chamfer.

Thread shall be coarse-thread series for square ma-

chine-screw or stove-bolt nuts and coarse- or fine-thread series for hexagon machine-screw nuts; Class 2B.

Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

The bearing surface of machine-screw nuts shall be at right angles to the axis of the threaded hole within a tolerance of 4 degrees.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.



## Up to twice as much production per .001" of wear!

### TEST REPORT SHOWS THERE IS A DIFFERENCE IN BUSHINGS

Ex-Cell-O Bushings out-perform competition.

An automotive manufacturer proved this conclusively by putting Ex-Cell-O Bushings up against two other leading brands in a practical, on-the-job test. Result: Ex-Cell-O out-produced brand A by 1210 pieces, brand B by 345 pieces! Average number of parts produced during .001" wear:

|           |              |
|-----------|--------------|
| Brand A   | 1,045 pieces |
| Brand B   | 1,910 pieces |
| Ex-Cell-O | 2,255 pieces |

An important reason for this outstanding performance is that Ex-Cell-O uses high chrome and high

carbon oil-hardening steel, heat treated in Ex-Cell-O's automatic atmosphere-controlled equipment to uniform 62-64 Rockwell "C." These bushings are precision ground inside and out and under the head for perfect seating. Try Ex-Cell-O Bushings and see for yourself.

For "same day" shipment write or wire Ex-Cell-O in Detroit or call your Ex-Cell-O Representative. Catalog available on request.

XLO

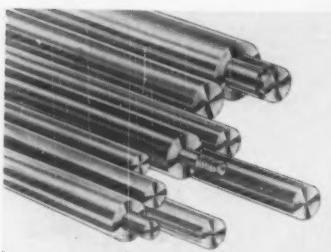
EX-CELL-O  
FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS  
AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

**EX-CELL-O**  
CORPORATION  
DETROIT 32, MICHIGAN

quirement. Screw threads are precision machined for easy installation. The knobs can be used to hold down covers and clamp heavy work-pieces; also, as a component in the construction of various types of jigs and fixtures; and on some types of metalworking machines.

**Circle Item 155 on postcard, page 233**



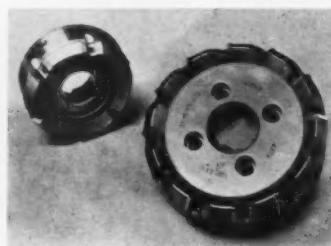
### Hardened and Ground Steel Bar Stock

Thomson Industries, Inc., Manhasset, N. Y. has announced the availability of hardened and ground steel bar stock. The bars, designated "60 Case," are made from AISI 1060 steel and have a surface hardness close to 60 Rockwell C. Depth of hardness ranges from 0.040 inch minimum in the

smallest diameter bar to 0.100 inch in the largest bar.

Standard sizes vary from 1/4 inch to 4 inches in diameter and from 8 to 14 feet in length. Tolerances range from plus 0.0000 and minus 0.0015 inch on smaller sizes to plus 0.0000 and minus 0.0025 inch on larger sizes. Typical parts that may be made with this material are guide rods, shafting, rolls, traverse rails, piston rods, arbors, guide posts, mandrels, and spindles.

**Circle Item 156 on postcard, page 233**

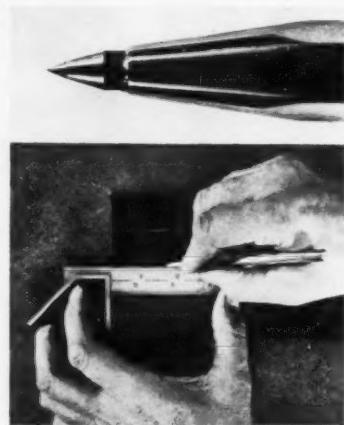


### Wesson Milling Cutters with Throw-Away Inserts

"No-grind" milling cutters using low-cost, indexable throw-away "Wessonmetal" carbide inserts with commercial-ground thickness

tolerances introduced by the Wesson Co., Ferndale, Mich. While retaining all features of the previous series, the new cutters serve to further advance the utilization of throw-away inserts for milling. Most of the new features incorporated in these cutters are traceable to the design of the locking mechanism. The throated wedge is drawn in place by a special differential screw having a left-hand coarse-pitch thread on one end and a right-hand fine-pitch thread on the other. The wedge has a 15-degree wedge angle. As a result, only one-half turn is needed to completely unlock or lock the insert. The fine-pitch thread is located in the wedge so the screw head, for all practical purposes, is always flush with the throat of the chip gullet, insuring smooth and well-controlled chip flow.

**Circle Item 158 on postcard, page 233**



### "Micro-Scriber" for Layout Work

Scriber designed for die layout, scoring, engraving, and marking operations in toolrooms, machine tool repair shops, industrial plants, and sheet metal shops, as well as for marking service dates on production equipment and business machines. This lightweight scribe, named the "Micro-Scriber," can be utilized to scribe or etch all metals including hardened steel, aluminum, corrugated sheet, brass, bronze, Monel, and precious gems, glass, ceramics, plastics, etc. Its solid carbide tip is diamond-ground and precision-lapped. The carbide tip is secured

### Large-Capacity Manually Operated Metal-Cutting Blowpipe

Oxweld C-63 manually operated metal-cutting blowpipe, featuring separate oxygen lines for preheating and cutting, introduced by Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, New York City. This blowpipe is said to have a greater preheating capacity than any standard manually operated blowpipe previously available. Ample preheat is provided for cutting metal of any thickness up to 55 inches in a single pass. A separate oxygen supply line provides

stable preheating flames which are unaffected by operation of the cutting oxygen valve. Valves are separated from the main body of the blowpipe for more convenient operation and maintenance. Flashbacks are virtually eliminated by use of a cartridge type mixer which provides thorough and uniform mixing of gases. The blowpipe is designed to use medium pressure acetylene but cutting nozzles are also available for use with other fuel gases.

**Circle Item 157 on postcard, page 233**



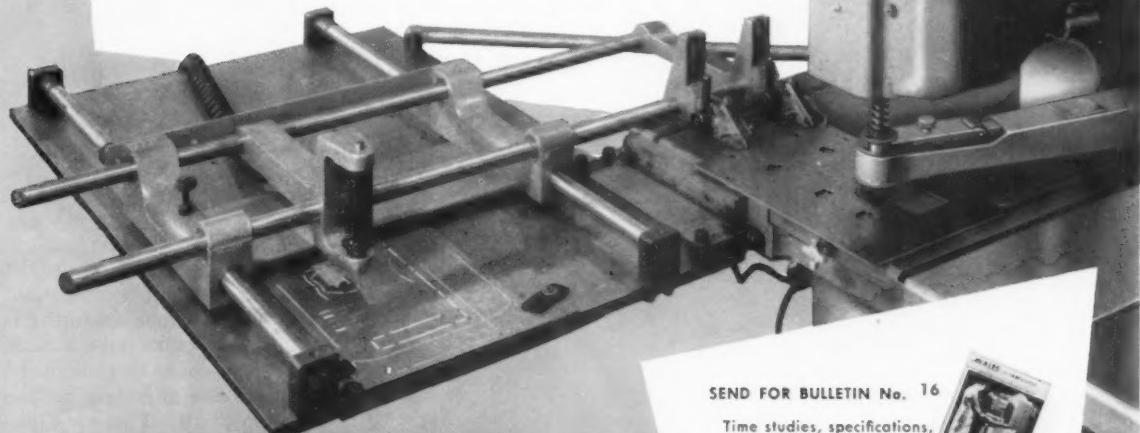


# Duplicate holes Automatically!

with the WALES FABRICATOR-DUPLICATOR

**Punch accurate holes  
from any master template!**

Holes in the template, mounted on the Duplicator, are automatically precision punched in the work piece . . . which is mounted on the Fabricator. Any size or shape hole within the limits of 3½" dia. can be handled on a quick change basis. Punch and die changes are made in seconds so that patterns with various size holes can be duplicated at high speed. This equipment is a complete punching shop in itself . . . fast . . . accurate . . . rugged and priced within the reach of any shop.



**WALES Strippit COMPANY**  
"...the Wales-Way is the PLUS-PROFIT way"  
**AKRON, NEW YORK**

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

SEND FOR BULLETIN No. 16

Time studies, specifications,  
illustrations etc., are all  
yours for the asking.



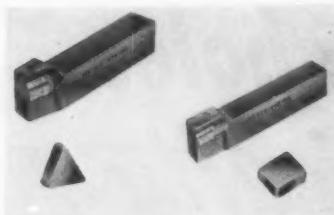
#### WALES MOBILE FIELD UNITS

We'll bring the Fabricator  
Duplicator right to  
your door for a  
demonstration.  
Ask for details.



within the tool and is mounted in a polished hexagonal aluminum handle. Introduced by the Greist Mfg. Co., New Haven, Conn.

Circle Item 159 on postcard, page 233



### Tool-Holders for Throw-Away Carbide Inserts

Two types of tool-holders for throw-away carbide inserts have been brought out by the Besly-Welles Corporation, South Beloit, Ill., for use in the metalworking industries. These holders are designed to facilitate the application of low-cost carbide inserts with

mass-produced cutting edges. Positive insert location, inexpensive interchangeable replacement parts, and a wide selection of negative and positive rake holder styles, sizes, and shanks are features of these tool-holders.

Circle Item 160 on postcard, page 233



### Carbide-Tipped Drills for Cast Iron

Series 333 carbide-tipped drills, designed specifically for fast, efficient drilling in cast iron, an-

nounced by Ace Drill Corporation, Adrian, Mich. These drills are manufactured with a special fluting, heavy web, and slow spiral to provide greater tool strength and rigidity. The uniformly hardened ground-from-the-solid, high-speed steel drill body has been combined with a selected tungsten-carbide tip to provide a drill that cuts cleanly, ejects chips readily, and resists wear on the cutting edge. The specially designed point also facilitates fast, easy penetration of the work.

Circle Item 161 on postcard, page 233

### Graymills Solvent Tank

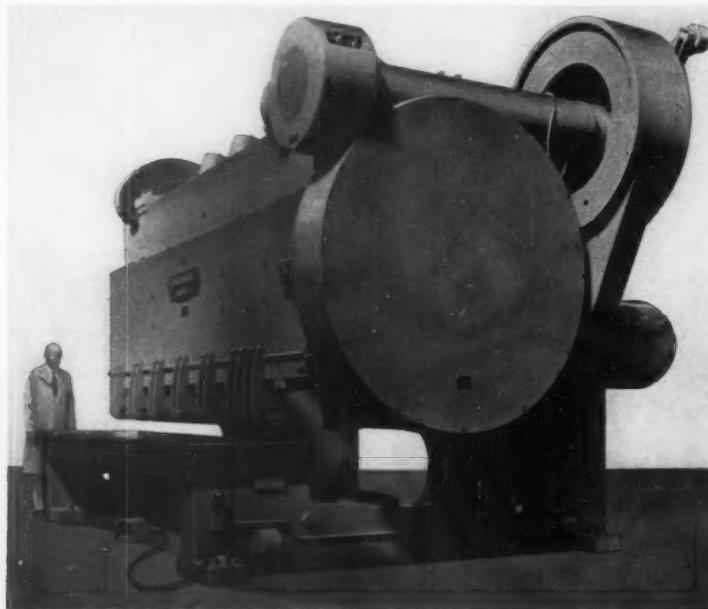
Solvent tank for the safe cleaning of metal parts and assemblies announced by the Graymills Corporation, Chicago, Ill. Tanks of this type can be combined in numer-

### Cincinnati Giant-Size Shear

Giant-size shear with capacity for cutting-off mild steel plate 12 feet wide by 1 1/2 inches thick built recently by the Cincinnati Shaper Co., Cincinnati, Ohio. This 15012 Series machine is said to be the largest shear ever built by the company. Features include all-steel interlocked construction, 36-inch

throat, high-pressure hydraulic hold-down system, front-controlled power-operated back gage with 48-inch range, air-electric clutch control, and ball transfers in the table. Micrometer accuracy in shearing is held at an operating speed of fifteen strokes a minute.

Circle Item 162 on postcard, page 233



ous ways to provide a complete, low-cost cleaning system for a wide range of manufacturing operations. All tanks have a fusible link safety cover to provide protection in case of fire and are built to comply with Factory Mutual Standards. The No. 1-W tank illustrated is equipped for air agitation with the automatic safety cover. All models in the line have safety covers but not all have the air-agitation feature. The tank is 24 inches long by 20 inches wide by 18 inches deep and is made of 14- and 15-gage steel.

Circle Item 163 on postcard, page 233

(This section continued on page 222)

**FOUND WHERE AIRCRAFT POWER AND CONTROLS TAKE SHAPE**

## **GRAND RAPIDS GRINDERS**

*Bendix*

BENDIX PRODUCTS  
DIVISION  
BENDIX AVIATION  
CORP.



FAIRCHILD ENGINE  
DIVISION  
FAIRCHILD ENGINE  
AND AIRPLANE CORP.



FORD INSTRUMENT  
COMPANY  
DIVISION OF  
SPERRY RAND CORP.



HAMILTON  
STANDARD DIVISION  
UNITED AIRCRAFT  
CORP.



LEAR, INCORPORATED



ORENDA ENGINES  
LIMITED



PRATT & WHITNEY  
AIRCRAFT  
DIVISION OF UNITED  
AIRCRAFT CORP.

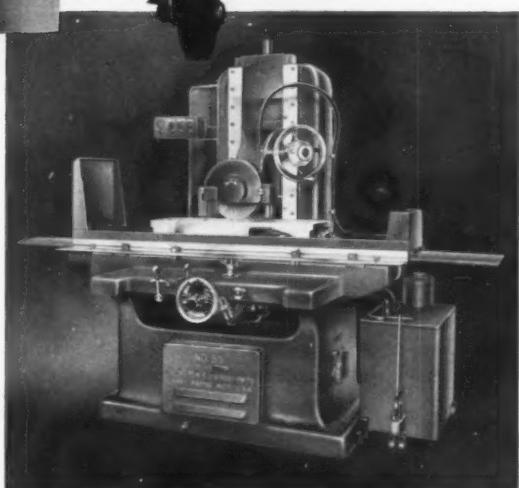


WRIGHT  
AERONAUTICAL  
DIVISION  
CURTISS-WRIGHT  
CORP.

**GALLMEYER  
& LIVINGSTON**



SUPER SABRE F-100  
NORTH AMERICAN  
AVIATION, INC.



GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE  
GRINDER. Table speed up to 125 fpm. Working sur-  
face of table is 12" x 36". Vertical movement of wheel  
head is 18". Preloaded ball bearing spindle greased  
for life. Spindle speeds 1925 and 2500 rpm.

A note on your let-  
terhead will bring  
full details.

**GALLMEYER & LIVINGSTON COMPANY**

305 Straight Ave., S.W., Grand Rapids, Michigan

### Fafnir Ball Bearing with "Ply-Seals"

Wide inner ring ball bearing equipped with "Ply-Seals" announced by the Fafnir Bearing Co., New Britain, Conn. The "Ply-Seal" type wide inner ring ball bearings are said to have demonstrated exceptional ability to seal out excessive amounts of contaminants at slow to moderate speeds while effectively retaining the supply of grease. The "Ply-Seal" as incorporated in the bearing shown consists of two "dished" steel plates between which is sandwiched a synthetic, rubber-impregnated fabric sealing washer. Both steel plates are fixed securely in an outer ring groove,

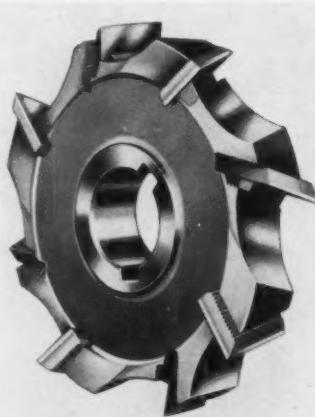
bodies; one to stagger the teeth when interlocking tooth cutters are required; and the other to line up the teeth when cutters are



### Tool with "Turn-Over" Carbide Button Inserts

Two-in-one Kendex tool with button inserts having sixteen indexable cutting edges per insert developed for facing and chamfering in a single operation by Kennametal Inc., Latrobe, Pa. The Kendex "turn-over" carbide button inserts are only 1/2-inch square and are said to provide economical and efficient applications of carbide cutting materials.

Circle Item 167 on postcard, page 233



used for straddle-milling thin parts. All chip spaces are polished for free-flowing chip disposal.

Circle Item 165 on postcard, page 233

### Thriftmaster Fixed-Center Milling Head

Large size, fixed-center milling head of special design built by Thriftmaster Products Corporation, Lancaster, Pa. This head can be mounted on the over-arm of a milling machine and supported against the machine column. Special short type milling machine spindles with standard No. 50 taper use form cutters. The short spindles eliminate overhang and provide rigid support for the tools. An oil pump provides oil lubrication for all bearings and gears.

Circle Item 166 on postcard, page 233

and the inner plate provides a rigid backing for the seal washer and a close-clearance baffle for retention of grease.

Circle Item 164 on postcard, page 233

### Goddard & Goddard Slotting Cutter

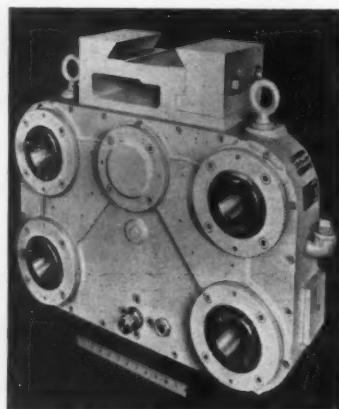
One of a new series of flat-faced blade, staggered-tooth slotting cutters for use on aluminum and its alloys as well as other light metals, now available from the Goddard & Goddard Co., Detroit, Mich. Standardized in 102 sizes, this new WAD series provides cutters ranging from 3/8 inch to 2 inches wide, and from 4 to 16 inches in diameter. The cutters are designed to provide maximum flexibility in meeting the various cutting conditions encountered in milling aluminum and other light metals and their alloys. Two keyways are provided on all cutter

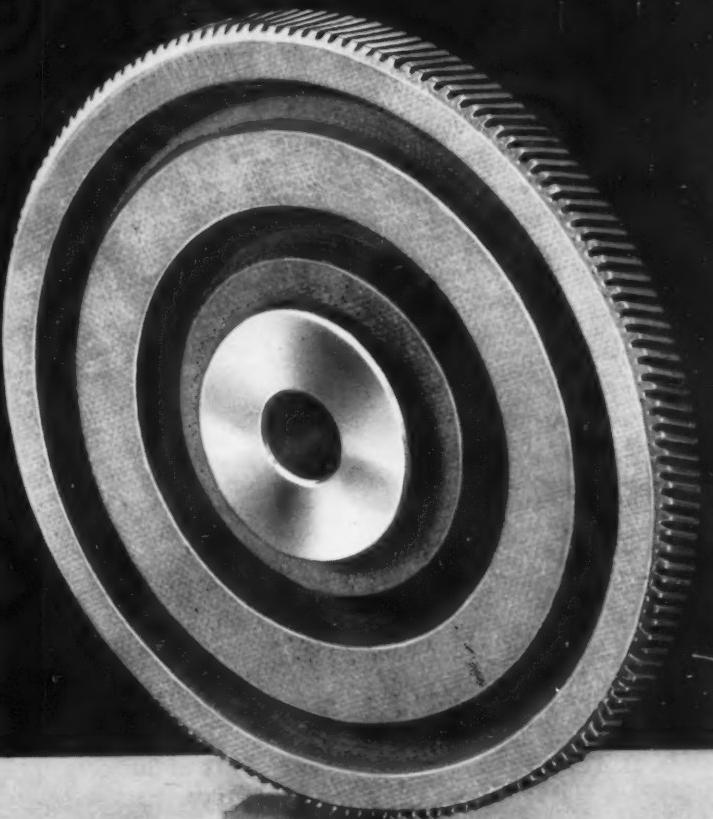


### Oil-Hydraulic Reducing Valve

One of two low-pressure type, pressure-reducing valves for industrial oil-hydraulic systems now available from Vickers Incorporated, Detroit, Mich. The new units feature an unusually broad pressure-adjustment range, being capable of providing any controlled reduced outlet pressure from 25 to 1000 pounds per square inch. They are intended primarily for use in industrial hydraulic systems to control the maximum operating pressure of secondary circuits and thus prevent possible damage to machinery or to a part being produced. Both valves are for use with 3/8-inch nominal pipe size in systems having operating pressures up to 2000 pounds per square inch.

Circle Item 168 on postcard, page 233





**GEAR**  
**Specialties, Inc.**

2635 WEST MEDILL AVENUE  
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS  
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS  
OF FRACTIONAL HORSEPOWER GEARING

**IF YOU NEED VIBRATIONLESS GEARS  
IT'S A JOB FOR  
G.S. PATENTED GROOVES**

G. S. research has now overcome vibration and flutter in Small Gearing for many vital applications. G. S. PATENTED GROOVES, as pictured here, successfully insulate vibrations of worm and gear teeth from reaching the shaft. Ultra smooth, noiseless operation is more than ever assured by the use of Bakelite Gears. ★ Whatever YOUR Gearing problem, you can depend upon G. S. research and engineering to lend powerful aid in reaching a successful solution. Here, you can, without cost or obligation, draw upon experience gained through 40 YEARS of specialization in the design and mass production of better Small Gearing exclusively. Send drawings and particulars today. Get the ONE best and most economical application for the job!

**SEND FOR FREE** 6-page Small Gearing Guide. It describes 80 types and applications. Contains useful charts . . . a valuable aid to anyone interested in Small Gearing. Use company letterhead, please. No obligation, of course. Write today!



*40 Years of Specializing in Small Gearing!*



# Between Grinds

By E. S. Salichs

## Prognostic Acrostic

Rolling in with the New Year are our very best wishes to all of MACHINERY's readers for happiness and prosperity in 1957, with the common goal of

P roductivity  
E ducation  
A dvancement  
C ooperation  
E nterprise

## Trapped by a Tap

A. H. d'Arcamal, who recently retired as president of Pratt & Whitney, recalled in *The News* (P & W monthly) a practical joke played on cocky apprentices while he was in the metallurgical department years ago. A few small taps made out of lead were kept on hand, and should an apprentice attempt to take over the small-tool

hardening room, he would be handed one of these pseudo taps with instructions to heat it in a lead bath at 1480 degrees F. for the proper length of time. The tap would, of course, melt immediately, and the apprentice would spend some time looking for it before admitting that it had disappeared.

## Punpointed Advice

The sign seen over an office drinking fountain: Old Faceful.

## The Voice of Business Experience

Bernard Lester, sales consultant and MACHINERY's longstanding monthly contributor to the Department "Talking with Sales Managers," has written a novel entitled *Weatherby Crisis*. In brief, it is an account of what happens when a

small industry whose founder had worked and lived among his men is turned over to an executive who never leaves the business office. Congratulations to our book-of-the-monthly columnist!

## Sandwich—to Go—Did

Friend of ours decided to have the interior of his automobile changed. When the mechanic disassembled one of the doors, he found a sandwich wrapped in wax paper inside the door. Somebody experimenting with his lunch on an automatic door? While on the subject of food, we must tell our experience the other day at a lunch counter. We ordered a ham on rye, and the waitress asked, "Bread?" We were tempted to reply, "No, balance it on a bottle of," but refrained.



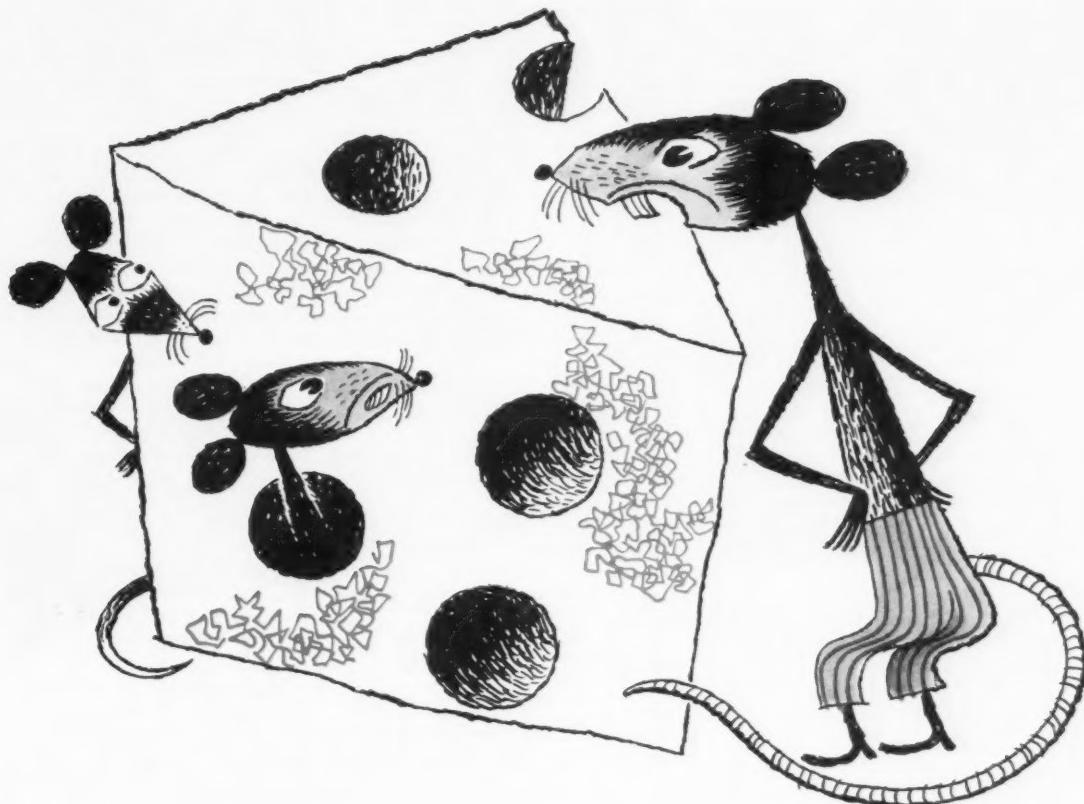
## MACHINERY'S Editor Cited by Drexel Institute

Drexel Institute of Technology awarded citations to a number of distinguished alumni at a Convocation held at the Academy of Music, Philadelphia, Pa., on December 2. The occasion opened a celebration of the sixty-fifth anniversary of the Institute. Among the citation recipients was Charles O. Herb, editor of MACHINERY, who was cited for "outstanding achievements and services in the field of engineering journalism."

Charles O. Herb, editor of MACHINERY being congratulated by Dean Kenneth W. Riddle of the Evening College of Drexel Institute of Technology. At right, John T. West, Jr., executive secretary, Pennsylvania Society of Professional Engineers.

# WHAT... NO UNIVERSAL DRILL

## BUSHINGS?



Wherever there are holes to drill using jigs or fixtures, it pays to specify Universal drill bushings. Machined from finest quality steel, Universal bushings have super-finished bores which lengthen tool life and reduce bushing wear over long production runs. Knurled heads provide quick, sure grip. Blended radii on top-inside diameters help prevent tool hang-up and breakage. Standard sizes and lengths in stock for immediate delivery.



FREE UNIVERSAL SELECTOR. Gives all engineering data for selection of all types and sizes of drill bushings up to 1 1/4" drill size. Send request on your company letterhead.

196

**UNIVERSAL ENGINEERING CO.**

FRANKENMUTH 2, MICHIGAN

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—225

# News OF THE INDUSTRY

## California and Texas

EDUARD BARUCH, vice-president and director of Topp Industries, Inc., Los Angeles, Calif., has been re-elected president and director of Heli-Coil Corporation, Danbury, Conn., a newly acquired Topp subsidiary. GIRA and LEO J. BRANCATO, Heli-Coil directors of engineering, were named vice-presidents.

MAX D. DAGGETT has been appointed field engineer for the Aeronautical Division of Robertshaw-Fulton Controls Co., Anaheim, Calif. He will serve the southwest area of the United States. His office will be 4924 Greenville Ave., Dallas, Tex.

S. E. HAVENS has been appointed district manager of the entire Pacific Coast territory for the Wright Hoist Division, American Chain & Cable Co., Inc., York, Pa. His headquarters will be at 890 Tennessee St., San Francisco, Calif.

GARRETT CORPORATION's Garrett Supply Division, Los Angeles, Calif., has acquired a 6-acre land site for expansion. Building plans are expected to be put into action in the near future.

PEERLESS PUMP DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION, Los Angeles, Calif., an-

nounces the appointments of MAX H. RICHTER, JR. and GEORGE RIES as sales engineers.

W. E. STAFF, JR., has been appointed applications engineer for J. B. Rea Co., Santa Monica, Calif.

DONALD M. MCGRATH has been named plant manager of the Solar Aircraft Co., San Diego, Calif.

CARPENTER STEEL Co., Reading, Pa., announces the opening of a mill-branch warehouse and office in Houston, Tex., to provide prompt sales and technical service to users of tool, stainless, and alloy steels in Texas, Louisiana, Mississippi, and the Mobile, Ala., area.

JOSEPH S. COWDY has been appointed district representative in Texas and Oklahoma for the Heppenstall Co., Pittsburgh, Pa. He succeeds CHARLES A. FISCHER. The company has established a district office at 3516 Mount Vernon, Houston, Tex.

## Illinois

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following appointments: THEODORE L. KISHBAUGH was named assistant vice-president in the procurement department of the Los Angeles steel

wire service plant. His headquarters will be in the company's general offices in Chicago. At the same time, WAYNE D. DUKETTE, manager of the Ryerson's San Francisco steel plant, will become general manager of the Los Angeles plant.

GITS BROS. MFG. Co.'s Shaft Seals Division, Chicago, Ill., announces the appointment of WILLIAM KUJALA as eastern district sales manager. Mr. Kujala's headquarters will be at the company's newly opened branch office at 36 Grand Ave., Englewood, N. J., covering New England, New York, New Jersey, and eastern Pennsylvania. Mr. Kujala will provide expanded sales with engineering service for Gits Shaft Seals customers, as well as personal sales and engineering supervision of Gits sales representatives in the area.

KUMA TOOL CO., division of Production Tool Corporation, Chicago, Ill., announced the completion of its move to new and enlarged facilities at 3845 S. Lowe Ave., Chicago, Ill.

ILLINOIS GEAR & MACHINE CO., Chicago, Ill., announces the election of three vice-presidents: T. S. PACER, E. B. SMILEY, and G. P. SULLIVAN. All three men, occupying key positions, have served with the company for over twenty years.



(Left to right) T. S. Pacer, E. B. Smiley, and G. P. Sullivan, vice-presidents of Illinois Gear & Machine Co.

**FINER  
ACCURACY**

**MINIMUM  
MAINTENANCE**

**LOWER  
GAGING COSTS**

*Presenting  
the new*

# DEARBORNAIRE

COLUMN-TYPE AIR GAGING INSTRUMENT

Never before has there been an air gage instrument quite like the new Dearbornaire! For it incorporates a host of advanced design features that give you greater versatility and ease of operation with finer accuracy, minimum maintenance and lower gaging costs.

The characterized internal taper of its exclusive new glass tube assures positive linear accuracy over the full extent of the calibrated scales. Its zero-centered scales permit faster and easier reading . . . whether used for normal parts inspection, for statistical quality control, or as a tool setting gage. Interchangeability of its basic component parts simplifies conversion from one amplification to another . . . saves time, cuts costs. What's more, Dearbornaire's new higher rated pressure system and built-in circuit restrictions make it virtually self-cleaning . . . eliminate nuisance interruptions for service, reduce down-time to a minimum.

Single and multiple column instruments available now in standard amplifications of 1250-1, 2500-1 and 5000-1. Free demonstration arranged upon request. Write for complete information today!

AIR GAGE DIVISION

22038 BEECH STREET

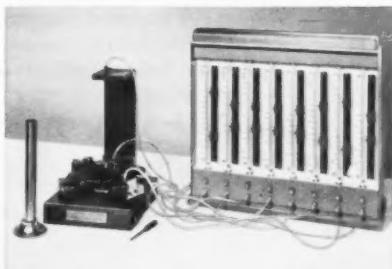


**DEARBORN  
GAGE COMPANY**

DEARBORN, MICHIGAN

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—227



Multiple column Dearbornaire instrument and a special fixture equipped with Dearborn contact cartridges to check eight close tolerance dimensions at one time.



(Left to right) Jacob J. Jaeger and Albert L. Knapp newly elected members of the board of directors; and Harry Reichert, vice-president of Pratt & Whitney Co., Inc.

JOHN R. DUFFY has been appointed chief engineer of the Lindberg Engineering Co., Chicago, Ill.

#### Indiana and Wisconsin

MINNEAPOLIS-HONEYWELL REGULATOR CO., Minneapolis, Minn., announces the planned construction of a half-million-dollar manufacturing facility in Wabash, Ind.

CHICAGO FLAME HARDENING CO. is opening a new plant at 420 E. 151st St., East Chicago, Ind. JOHN R. KEELER is general manager of this concern.

ROBERT J. SUTTON has been named director of purchases of Atkins Saw Division of Borg-Warner Corporation, Indianapolis, Ind.

F. JOHN PICHARD has been appointed manager of Standard Equipment Sales at Wheelabrator Corporation, Mishawaka, Ind. He will assist E. A. Rich, general sales mgr.

REGINALD KENNARD has been appointed field sales representative for the industrial division of the Warner Electric Brake & Clutch Co., Beloit, Wis.

#### Michigan

BALDWIN-LIMA-HAMILTON CORPORATION has named GERALD B. HALL and ROBERT E. BILLINGS as sales representatives for testing machines and SR-4 strain gages and SR-4 transducer cells and measuring equipment in the company's new office at 15800 W. McNichols Road, Detroit, Mich.

R. J. SULLIVAN has been appointed a director of quality control for Vickers Incorporated, Detroit, Mich. In his new position, Mr. Sullivan will be responsible for coordination of quality control activities at Vickers manufacturing divisions in Detroit; Omaha, Nebr.; Joplin, Mo.; and Jackson, Miss.

LOU D. GROVE has been appointed sales and engineering representative in New York State for Cone-Drive Gears Division, Michigan Tool Co., Detroit, Mich. Mr. Grove will represent the complete line of Cone-Drive double-enveloping worm gear speed reducers and gear sets, including both shaft-mounted and motorized models.

DEARBORN GAGE CO., Dearborn, Mich., announces the purchase of a 10-acre tract of land for expansion purposes in Garden City, a suburb west of Detroit. The company plans to construct new plant facilities which will include 15,000 square feet of manufacturing floor space.

EDWARD H. PERKINS, JR., has been elected vice-president of Brooks & Perkins, Inc., Detroit, Mich. Mr. Perkins is also manager of the company's Magplate Division.

AIR REDUCTION SALES CO., a division of Air Reduction Co., Inc., New York City, announces the acquisition of the assets and business of JACKSON PRODUCTS, INC., Detroit, Mich.

LANDIS MACHINE CO., Waynesboro, Pa., announces the relocation of its Detroit office to 12806 Fenkell Ave., Detroit, Mich.

#### New England

PRATT & WHITNEY CO., INC. West Hartford, Conn., announces the following executive appointments: JACOB J. JAEGER and ALBERT L. KNAPP have been elected to the board of directors. Mr. Jaeger is vice-president of the company and chief engineer of its Machinery Division, and Mr. Knapp is also vice-president and manager of the Machinery Division. At the same time it was announced that HARRY REICHERT, export manager since 1950, has been named a vice-president of the company. Mr. Reichert has served the company during the past thirty-one years in various capacities.

LOUIS B. STONER, president of the Jacobs Mfg. Co., West Hartford, Conn., has been made a director of the Chicago Pneumatic Tool Co., Chicago, Ill. In 1953, Chicago Pneumatic acquired the Jacobs Mfg. Co. Mr. Stoner succeeds L. F. HOFFMAN, who has resigned as a director.

CUNO ENGINEERING CORPORATION, Meriden, Conn., announces the appointment of two sales representatives for the Indiana and Ohio area. They are: JOHN R. CARLSON Co., 4808 Broadway, Indianapolis; and E. C. GEORGE Co., 2412 Far Hills Ave., Dayton.

BULLARD CO., Bridgeport, Conn., announces the purchase of the HYDRA-FEED line of automatic and tracer-controlled lathes, including designs and patents, from HYDRA-FEED MACHINE TOOL CORPORATION, South Norwalk, Conn., and Detroit, Mich.

*(This section continued on page 230)*

# Use V-R Quality Carbides

For Tools and Parts  
Like These . . .



## Get the Facts Today . . .

**Standards.** Vascoloy-Ramet manufactures and stocks a complete line of standard cemented carbide blanks for solid and tipped cutting tools . . . wear parts . . . punches . . . dies . . . gages . . . bushings . . . guides . . . mandrels . . . lathe centers . . . chisels . . . router bits . . . end mills . . . and hundreds of other items.

**Specials.** V-R produces custom made carbide blanks for flat and circular form tools and all special cutting tools and wear parts.

**Grades.** V-R standard grades of cemented carbides will fit most applications.

**Quality.** V-R advanced manufacturing and control procedures assure you of consistent uniformity of product.

ASK FOR CATALOG — complete dimensional and price data on hundreds of stock blanks and cutting tools. Call your local V-R Representative or Distributor . . . or write:



Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

802 Market Street, Waukegan, Illinois

Since 1930  
Leader in the Manufacture  
of Quality-Controlled Carbides



C-588

**CLINTON E. SMITH** has been named assistant to the general sales manager of Pratt & Whitney Co., Inc., West Hartford, Conn. Mr. Smith has been with the company since 1931.

**J. DOUGLAS PATRICK** has been appointed product development engineer of MacDermid, Inc., Waterbury, Conn.

**C. J. WILSON** has joined the Bulard Co., Bridgeport, Conn., as director of manufacturing. Mr. Wilson was formerly with the Westinghouse Electric Corporation.

**RALPH E. BOND**, has been appointed deputy general manager of American Machine & Foundry Co.'s electronics division, Boston, Mass.

### New York and New Jersey

**RUSSELL, BURDSALL & WARD BOLT AND NUT CO.**, Port Chester, N. Y., announce the appointment of two assistant Western sales managers. They are **WILLARD DUNHAM** and **HENRY STEERS**. Both posts are in the company's Chicago office.

**UNION CARBIDE AND CARBON CORPORATION**, New York City, announce the formation of a Research Institute which will engage in basic scientific research. Dr. AUGUSTUS KINZEL will be in charge.

**HARRY E. GUDE** has been named general manager of the Omal Rolling Mill of the Aluminum Division of Olin Mathieson Chemical Corporation, New York City.

**CLAYTON DUBOSQUE, JR.** has been appointed assistant to the executive vice-president of American Machine & Foundry Co., New York City.

**FRANK E. LAWATSCH** has been named manager of the Marine & Oil Processing Division of the De Laval Separator Co., Poughkeepsie, N. Y.

**STANDARD GAGE CO., INC.**, Poughkeepsie, N. Y., announces the appointment of **E. S. PHILLIPS & CO.**, Pittsburgh, Pa., as representatives.

**THOMAS P. TURNBULL** has been appointed service manager for the Instruments Division of North American Philips Co., Inc., Mount Vernon, N. Y.

**ADAMAS CARBIDE CORPORATION**, Kenilworth, N. J., announces the appointment of **ROBERT H. GESSNER** of R. H. Gessner Co., as its western New York sales representative. He will operate from his Buffalo, N. Y., office. At the same time, the appointment of **ROY M. HOUCK**, Santa Monica, Calif., as Western district manager was announced.

**AJAX ENGINEERING CORPORATION**, Trenton, N. J., and **AJAX ELECTRIC FURNACE CORPORATION**, Philadelphia, Pa., announce that they are combining their engineering, manufacturing, and sales efforts.

### Ohio

**CLEVELAND WORM & GEAR CO.**, Cleveland, Ohio, announces the following executive appointments: **LEE O. WITZENBURG**, formerly the com-

pany's general sales manager, has been appointed vice-president in charge of sales for both the company and its affiliate, the Farval Corporation. **JOHN R. DINGLE** has been appointed vice-president in charge of manufacturing for both firms. Mr. Dingle has been associated with the company since 1946. **SIDNEY L. EASTMAN** has been appointed vice-president in charge of engineering. Mr. Eastman has been associated with the firm in the various engineering and sales capacities since 1927.

**STERLING DIE DIVISION OF PRATT & WHITNEY CO., INC.**, has completed its move to a new plant location in the Southwest Industrial Park section of Cleveland that will more than treble its manufacturing facilities. The new plant is located at 13811 Enterprise Ave., Cleveland, Ohio, and houses both the company's administrative offices and production facilities.

**RELIANCE ELECTRIC & ENGINEERING CO.**, Cleveland, Ohio, has opened a distribution center in Elizabeth, N. J. **KENNETH R. WRIGHT**, formerly estimating engineer at the company's Newark sales office, has been named supervisor of the new center.

**WILLIAM J. RYAN** has been appointed shop superintendent of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

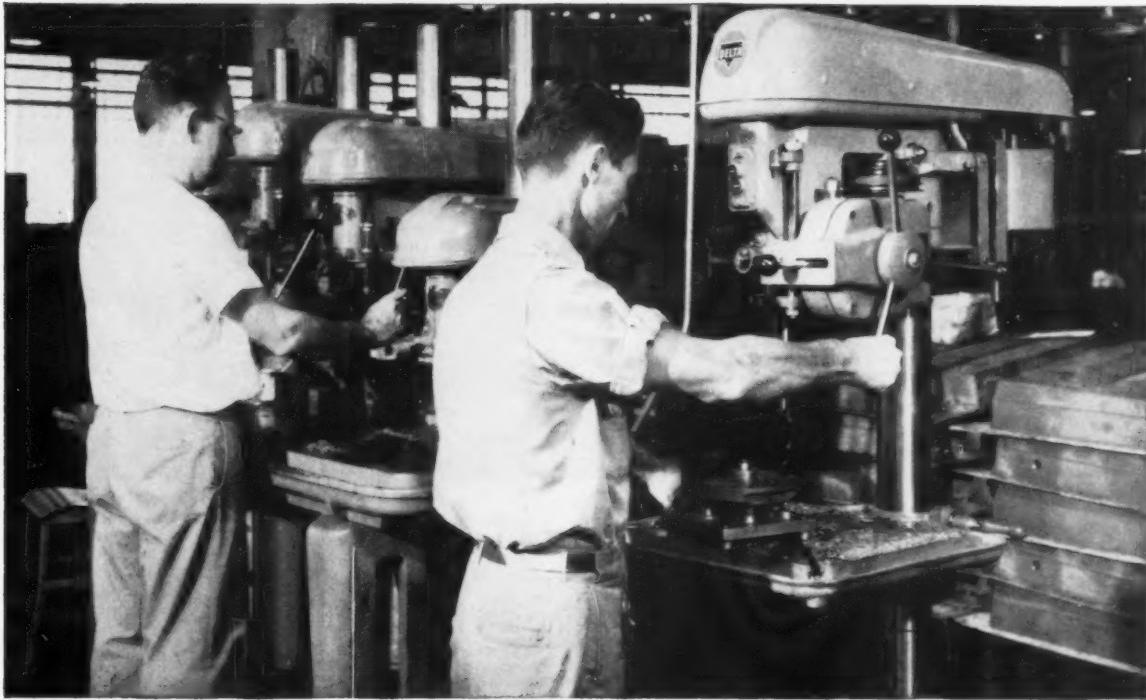
**FRANK X. ZENISEK** has been appointed sales manager of Midwest Screw Products, Inc., Cleveland, Ohio.



(Left to right) Lee O. Witzenburg, vice-president in charge of sales, and John R. Dingle, vice-president in charge of manufacturing for Cleveland Worm & Gear and its affiliate, Farval Corporation. Sidney L. Eastman, vice-president in charge of engineering.

ROCKWELL-BUILT

# new **DELTA** 20" drill press



## ...fills need for low cost production tooling

Delta's great new 20" Drill Press was designed, engineered and built to fill industry's growing need for *flexible* production tooling. Here is why it can save you money by handling jobs normally requiring machines *costing four and five times as much*:

**BIG MACHINE CAPACITY**—You get full 6" spindle travel and long 5½" high column for *extra* spindle to table capacity, backed by massive construction and rugged power to match! It's a real production tool for jobs ordinarily demanding big, expensive special-purpose machines.

**POWER TOOL VERSATILITY**—New Delta 20" can be used singly for a wide range of production jobs, yet readily adapts to work in combination with special-

purpose machines. And you can move it *where you need it* to reduce materials handling, save costly man hours.

**LASTING PRECISION**—Delta's 30 years of unmatched quality power tool experience give you precision and performance features that assure exacting tolerances (and lower maintenance) through years of hard, continuous operation.

**SEE THE ENTIRE DELTA DRILL PRESS LINE**: Get all the facts about the new Delta 20" plus other new and improved Delta Drill Presses. Compare for quality, for precision, for value—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

**Send coupon for all the facts!**



another product by  
**ROCKWELL**



**Delta Power Tool Division, Rockwell Manufacturing Co.  
614A N. Lexington Ave., Pittsburgh 8, Pa.**

- Please send complete catalog on entire Delta Drill Press line.
- Please send booklet: Delta Power Tools Teamed with Machine Tools.
- Please send names of my nearest Delta Dealers.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ County \_\_\_\_\_ State \_\_\_\_\_



# save money minutes, metal

with

**B&W MECHANICAL  
TUBING**

CARBON • ALLOY • STAINLESS



Countless hollow parts and products now being made from solid stock can be fabricated more economically from tubing. The hole is there, eliminating heavy drilling with all its attendant waste. And the wide range of sizes, shapes, analyses, finishes and heat-treated conditions in which B&W Mechanical Tubing is available, make it a semi-finished product in itself — reduce all your machining operations to the minimum.

Get the facts on savings from Mr. Tubes, your link to B&W and your local B&W tubing distributor.

Write for *Guide to the Use of Seamless Mechanical Tubing*, Technical Bulletin 340.

The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels



# PRODUCT INFORMATION SERVICE

**Use postage-free Business Reply Cards for further information  
On New Catalogues described in this issue of MACHINERY  
On New Shop Equipment described in the editorial pages  
On products shown in the advertisements**

## NEW CATALOGUES

**TINPLATE HANDBOOK**—Tin Research Institute, Inc., Columbus, Ohio. Booklet describing tinplate and how it is made. Section II gives production figures up to the end of 1955. Section III, on manufacture, runs briefly through the steel-making and rolling processes and then outlines two methods of tinning by dipping in molten tin and by electrodeposition. Section IV, on grades, gives information on the thickness or weight of tin coating. The units used for measuring coating thickness or weight are defined in detail, with conversion tables from English and American to metric units. Section V, qualities, refers to the classification of the product into primes, seconds, and variants of these, and also describes "menders." The next two sections deal with the practical aspects of the packing of tinplate for safe transportation. Application of various grades of tinplate are indicated in Section IX. An extensive glossary of 100 terms in current use in the tinplate industry is given in English, French, German, and Spanish. Copies of this handbook are available free of charge from Tin Research Institute, Inc., 492 W. Sixth Ave., Columbus 1, Ohio.

**BRUSHING MACHINES**—Osborn Mfg. Co., Cleveland, Ohio. 100-page catalogue entitled "Brushes for Industry," containing detailed information on how to select and use power brushes, Brushomatic machines, paint and varnish brushes, and maintenance brushes. A chapter "How to Select Power Brushes" covers: examples of power brush uses, power brush types, terminology, engineering data, and similar information. Another section of the catalogue describes the company's Brushomatic machines. Osborn power brushes are covered next in this catalogue. Complete and detailed specifications are given for every brush in the line. This catalogue may be obtained free of charge by writing to Richard M. West, Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

**DIE SETS AND ACCESSORIES**—Producto Machine Co., Bridgeport, Conn. 76-page catalogue listing and describing the company's die sets and accessories. The 56-page technical section and the 20-page net price book have been printed separately and bound to-

gether in such a way that they can be read simultaneously. This catalogue introduces many new items such as rectangular progressive rear pin die sets; watchmaker die sets; die sets for Multi-Slide four-slide and dieing machines; removable bronze bushings; and an added line of chrome-vanadium steel die springs and a packaged die spring assortment. Also included are Qwick-Fit guide pins for trouble-free die set assembly and disassembly, redesigned steel and shoulder bushings, a selection of lubrication devices, bolster plates, and toolroom equipment. To obtain a copy of this No. 11 catalogue, write to the Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn.

**CONVERSION CHART**—Opto-Metric Tools, Inc., New York City. Inch-millimeter conversion chart which not only permits conversion of fractional inches into decimals and millimeter equivalents, but also shows conversion of decimal millimeters into inch decimals. Further, any intermediate decimals may be regularly computed. For this chart write to Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.

**ROLLING MILLS**—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. 36-page, ring-bound catalogue describing the company's complete line of rolling mills and rolling mill auxiliary equipment for ferrous and non-ferrous metals. Covering over twenty-five different types of machinery, the catalogue is grouped into three sections describing:

(1) main equipment—strip mills, rod mills, special mills, gang slitters, and chain draw benches; (2) auxiliary equipment for strip, rod, wire, and tube mills; and (3) reference tables including strip, coil, weight, length-calculating graphs, and tandem rod mill rolling schedules. 1

**BAKELITE PLASTICS**—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City. Catalogue entitled "Condensed Reference File of Bakelite Plastics." Distinguishing characteristics, appropriate fabricating techniques, and major fields of application are clearly defined for each different group of plastics. These groups include polyethylenes, vinyls, phenolics, styrenes, epoxies, and polyesters supplied by the company for industrial use. More than eighty photographs and sketches illustrate some typical uses. .... 2

**THROW-AWAY TOOLING**—Wesson Co., Ferndale, Mich. Technical bulletins 896-1 and 2, covering data on the company's latest addition to its "no grind" line of throw-away tooling. The tools covered in these bulletins are basically 30- or 45-degree chamfering tools which may also be used for a variety of other operations and are well suited to gang setups. In addition to photographs, drawings, and specifications the bulletins illustrate typical applications. .... 3

**VARIABLE-SPEED WOOD LATHE**—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. 4-page, illus-

FIRST CLASS  
Permit No. 53  
(Sec. 34.9, P.L. & R.)  
New York, N. Y.

## BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY

93 WORTH STREET

NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

trated bulletin describing the company's big-capacity, Delta 12-inch, variable-speed wood lathe. Outstanding features of this lathe are illustrated with close-up photos of parts of a dismantled machine. Line drawings are used to explain the most complex features. The bulletin also includes complete listings of all motors and switches available for single-phase and three-phase operation. . . . . 4

**SPRAG CLUTCHES** — Formsprag Co., Van Dyke, Mich. Catalogue 104-C, giving complete information concerning the company's sprag clutches for overrunning, indexing, and backstopping applications. Described and illustrated are a wide range of actual current uses for these clutches in all three categories—from automobile transmissions to annealing furnaces; from duplicating machines to punch presses; and from cement-plant conveyor belts to jet-aircraft control actuators. . . . . 5

**LATHE**—Monarch Machine Tool Co., Sidney, Ohio. Bulletin describing the company's Model 21 Mono-Matic lathe which has a fully automatic cycle for every basic turning requirement. Information is also given on the multi-cycle programmer control system, air-gage tracer mechanism, constant surface cutting speed control, and optional automation system designed for competently mechanized handling of work-pieces. . . . . 6

**NUT SPECIFICATIONS**—National Machine Products Co., Utica, Mich. Catalogue representing a condensation of the company's 144-page catalogue giving basic engineering data and specifications on hexagon nuts, sizes 1/4 inch to 3 inches; pointer nuts 2 1/4 inches to 5/8 inch; "Huglock" and "Marsden" lock-nuts, sizes 1/4 inch to 1 1/2 inches.

This brochure, together with a 24-page engineering data section, provides all essential information regarding these products. . . . . 7

**MOTOR SELECTOR**—Reliance Electric & Engineering Co., Cleveland, Ohio. 12-page catalogue giving full information on how to select alternating-current motors for specific applications. Included are such comprehensive selection data as speed-frequency relationship, NEMA design classes, torque characteristics, NEMA current and torque values, frame selection tables, and dimension charts and mechanical modifications for all frame sizes from 182 to 6085. . . . . 8

**DUST CONTROL**—Pangborn Corporation, Hagerstown, Md. 16-page catalogue entitled "Dust Control for Industry," describing the importance of dust control for industry in relation to reduced maintenance costs, employee morale, and commercial utilization of dust by-products. The bulletin outlines standards of control and efficiency in dust collection, and lists the primary component parts of an engineered dust control system. . . . . 9

**ELECTRON MICROSCOPES**—North American Philips Co., Inc., Mount Vernon, N. Y. 12-page brochure entitled "Norelco Electron Microscopes," giving complete data on the construction and operation of electron microscopes. Covered are the electron optical system, pumping unit, electronics, high voltage, column, gun, magnetic beam alignment, condenser and aperture, beam wobbler, objective lens, and astigmatism. . . . . 10

**ALUMINUM STOCK**—Joseph T. Ryerson & Son, Inc., Chicago, Ill. 16-page bulletin listing the sizes and weights of

rod, bar, sheet, coil, plate, tubular, and building products of Reynolds aluminum carried in stock in Ryerson steel service plants in New York and New England. Guide to selection; data on cutting facilities, finishes, and mechanical properties are included. . . . . 11

**INDUSTRIAL LIGHTING**—Sylvania Electric Products, Inc., Wheeling, West Virginia. Booklet entitled "Prescribed Lighting Protects the Eyes of Industry," featuring sections on safety and visibility factors, standards for use in prescribing plant lighting, uses of fluorescent, incandescent, and mercury vapor lamps; light of other areas, maintenance, and condensed data on fixtures. . . . . 12

**FLUID POWER EQUIPMENT**—Oilgear Co., Milwaukee, Wis. Catalogue illustrating photographically the company's facilities for making some of the many precision machines and tools used in the production, quality control, and laboratory tests of heavy-duty fluid power equipment. Illustrated are early model Oilgear feed controls and machines, and modern application of Oilgear fluid power. . . . . 13

**TESTING MACHINES**—Tinlus Olsen Testing Machine Co., Willow Grove, Pa. 40-page bulletin giving complete information and specifications for the company's standard Electromatic universal testing machines of from 500- to 1,000,000-pound capacity, as well as comprehensive descriptions of the independent loading, weighing, and indicating systems featured on all models. . . . . 14

**GATE AND NEEDLE VALVES**—R-P&C Valve Division, American Chain & Cable Co., Inc., Reading, Pa. Bulletin describing the company's line of R-P&C forged steel gate and needle valves, specifically designed for petrochemical power and process industries. The bulletin lists material specifications, pressure temperature ratings, working processes, dimensions, and applications of the units. . . . . 15

**SHEAVE SPECIFICATION GUIDE**—Fort Worth Steel & Machinery Co., Fort Worth, Tex. Catalogue 83-A, listing 739 different stock sizes of the company's QD (quick-detachable) sheaves. The range of stock sheave sizes listed extends from a sheave 3.4 inches in diameter, weighing approximately 2 pounds, to a giant 6-foot sheave, weighing about 1 1/2 tons. . . . . 16

**HIGH-PRECISION MACHINE TOOLS**—Carl Hirschman Co., Inc., Manhasset, N. Y. 12-page catalogue featuring a selection of Swiss high-precision machine tools. Included are Tornos automatics; Kummer dual-head lathes; Hauser jig borers, jig grinders, and pivot burnishers; Schaublin lathes and milling machines; Walter cutter grinders; and many others. . . . . 17

**STAINLESS-STEEL BAR AND WIRE**—Armco Steel Corporation, Middletown, Ohio. Folder describing the company's various standard and special grades of stainless-steel bar and wire. Among the special grades are 17-4 PH, 17-7 PH, ELC and stabilized alloys, free machining stainless, 17-14 Cu Mo, 22-4-9 stainless, and 17-10 P stainless steels. 18

## Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

### CATALOGUES

|    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 |    |    |    |    |    |

### NEW SHOP EQUIPMENT

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 |
| 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 |
| 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 |
| 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 |
| 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 |     |     |

### ADVERTISED PRODUCTS

|                |                      |
|----------------|----------------------|
| Page . . . . . | Advertiser . . . . . |
| Page . . . . . | Advertiser . . . . . |
| Page . . . . . | Advertiser . . . . . |
| Page . . . . . | Advertiser . . . . . |

Please print your name and address

NAME . . . . .  
TITLE . . . . .  
COMPANY . . . . .  
CO. ADDRESS . . . . .  
CITY . . . . .  
ZONE . . . . . STATE . . . . .

This card is void after April 1, 1957

M-1/37

**GEAR-SHAVING CUTTERS**—National Broach & Machine Co., Detroit, Mich. Catalogue CR. 56-10, dealing with the care and use of gear-shaving cutters. Included are specification tables; mounting instructions; and data on speeds, feeds, coolant, cutter life, sharpening, storage, and cutter repair procedures. 19

**PLATED WIRE**—National-Standard Co., Niles, Mich. 8-page catalogue giving specifications and characteristics of Nickelply and Brassply electroplated steel wire. The wires are drawn by the company and plated with nickel or brass coatings that do not separate from the base metal under severe twisting, bending, flattening, or roll-threading operations. 20

**COBALT DRILLS**—Chicago - Latrobe, Chicago, Ill. Folder giving complete listing of the company's super cobalt drills. Sizes are in fractional, wire gage, and letter size drills including those with straight and taper shanks. Technical data is supplied as well as a listing of cobalt bonding bits with sizes and dimensions. 21

**MAGNETIC SHIELDING**—Magnetic Shield Division, Perfection Mica Co., Chicago, Ill. 33-page technical brochure entitled "Data Sheets 101 (1957)," describing construction features, performance characteristics, and typical applications of non-shock, sensitive, non-retentive Fernetic and Co-Netic magnetic shielding material. 22

**POWER - TRANSMISSION EQUIPMENT**—Standard Pressed Steel Co., Jenkintown, Pa. 4-page bulletin covering the company's Pioneer steel shaft hangers, hanger bearings, split journal bearings, heavy rigid pillow blocks, and Hallowell solid and split cast-iron collars. Individual tables for each item show principal dimensions, weight, and shaft sizes. 23

**LUBRICATION SYSTEMS**—Bijur Lubrication Corporation, Rochelle Park, N. J. Bulletin 4C, describing the company's line of automatic and semi-automatic, centralized lubrication systems for a wide range of small machines. A separate section of the bulletin discusses distribution systems, meter units, and installation details. 24

**HYDRAULIC DUAL-RELIEF VALVES**—Fluid Controls, Inc., Mentor, Ohio. Catalogue describing the company's line of hydraulic dual-relief valves. These valves are designed to protect hydraulic valves and motors from excessive pressures that occur when control valves are suddenly reversed or blocked, or when an external load is applied to the motor. 25

**FLEXIBLE COUPLINGS**—Morse Chain Co., Industrial Sales Division, Ithaca, N. Y. 24-page catalogue describing the company's torsionally flexible Morflex couplings. Complete dimensions and specifications are given on standard, double, and radial type couplings with additional data on coupling drive-shafts. 26

**PLATING AND PROCESSING EQUIPMENT**—Meeker Co., Chicago, Ill. Bulletin 856, illustrating the company's three versatile automatic machines—

the low-head, side-arm, automatic plating machine; the "Little Giant Utility" plating and processing machine; and the automatic barrel cleaning machine. Each model is fully described. 27

**PRECISION INSTRUMENT COMPONENTS**—PIC Design Corporation, East Rockaway, N. Y. Catalogue 11, listing over 4000 precision-instrument and servo parts available from the company's stock. Included in the 128-page booklet are compact and concise engineering data for use in the electronic and instrumentation fields. 28

**INDUSTRIAL PERISCOPE**—Lenox Instrument Co., Philadelphia, Pa. Catalogue describing the company's industrial periscopes—precision-built instruments that can be used in many industries for remote observation of inaccessible places, and for the study of hazardous processes from a safe viewing distance. 29

**LUBRICANTS**—Magnus Chemical Co., Inc., Garwood, N. J. 4-page bulletin

giving information on choosing the right lubricant for the specific condition. Each lubricant is listed by product name, with a detailed description of its properties and its specific application to metals and the concentrations used. 30

**INDUCTION MELTING FURNACES**—Inductotherm Corporation, Delanco, N. J. Bulletin 70, describing the company's complete line of induction melting furnaces and related equipment. Performance tables giving melting time of various quantities of molten metal are included. 31

**SILICONE LUBRICANTS**—Dow Corning Corporation, Midland, Mich. Brochure describing the company's silicone lubricants. Properties and performance of various silicone oils, greases and compounds are discussed; many typical applications are illustrated and described. 32

**SHELL MOLDING PROCESS**—Barret Division, Allied Chemical & Dye Corporation, New York City. 32-page illustrated

FIRST CLASS  
Permit No. 53  
(Sec. 34.9, P.L. & R.)  
New York, N. Y.

## BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

**MACHINERY**

**93 WORTH STREET**

**NEW YORK 13, N. Y.**

**READERS' SERVICE DEPT.**

FIRST CLASS  
Permit No. 53  
(Sec. 34.9, P.L. & R.)  
New York, N. Y.

## BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

**MACHINERY**

**93 WORTH STREET**

**NEW YORK 13, N. Y.**

**READERS' SERVICE DEPT.**

booklet entitled "Plaskon Resins for Shell Molding," describing the shell molding process for casting metals with particular emphasis on the foundryman's problems. .... 33

**POTENIOMETER INDICATOR**—Thermo Electric Co., Inc., Saddle Brook, N. J. Bulletin 64, describing the company's portable potentiometer indicator—the MiniMite. This extremely small instrument weighs under 4 pounds and measures about 4 by 5 by 6 inches. 34

**MAGNET WIRE**—Wire & Cable Division of the Electric Auto-Lite Co., Port Huron, Mich. 4-page catalogue including a handy reference table as well as electrical, physical, and chemical properties of the company's LectALite enameled magnet wire. .... 35

**MECHANIZED HEAT-TREATING**—Surface Combustion Corporation, Toledo, Ohio. Bulletin SC-176, explaining the economical features of completely mechanized heat-treat lines. Twenty-four basic mechanisms with isometric drawings are shown. .... 36

**GEAR-MOTORS**—Electro Counter & Motor Co., Chicago, Ill. Catalogue describing the company's unidirectional and reversible gear-motors. Detailed product designs and illustrations are accompanied by schematic drawings, performance figures, and torque ratings. .... 37

**ELECTRIC POWER DRIVES**—Sterling Electric Motors, Inc., Los Angeles, Calif. Catalogue covering normal speed electric motors, geared motors, variable-speed transmission, and speed reducers. Easy-to-read tables make drive selection simple. .... 38

**CARBIDE TOOLS**—Nelco Tool Co., Manchester, Conn. Catalogue 956, describing the company's 700 carbide and carbide-tipped tools—comprising a comprehensive list of carbide tools. Complete descriptions, specifications, and prices are given for each tool. .... 39

**INDUSTRIAL HEATING EQUIPMENT**—Lindberg Industrial Corporation, Chicago, Ill. 4-page bulletin covering large-size, field-erected production furnaces

for all forms of metal heat-treating and also for continuous enameling, aluminum-melting, and ceramic needs. .... 40

**LEAD-TESTING COMPARETOR**—Jerbak-Bayless Co., Solon, Ohio. Bulletin illustrating the company's portable lead-testing comparator giving descriptive information, as well as the range and accessories available for checking lead-screws. .... 41

**ULTRASONIC DEGREASING UNIT**—Industrial and Scientific Products Division, Caldwell, N. J., a division of Curtiss-Wright Corporation. Leaflet describing the company's Type DB2-5 ultrasonic degreasing unit for rapid cleaning and degreasing of metal parts. .... 42

**TUBE CAP CONNECTORS**—Alden Products Co., Brockton, Mass. Booklet comprising a complete guide to tube cap connectors for every type of tube. Contained are specifications on tube cap connectors for airborne and missile equipment. .... 43

**STRAPPING MACHINE**—Acme Steel Co., Chicago, Ill. Folder describing the company's F3 strapping and packaging machine designed for applications where compressible or solid units must be strapped quickly and economically. .... 44

**EPOXY RESIN ADHESIVES**—Minnesota Mining & Mfg. Co., Detroit, Mich. Technical bulletin giving engineering data on high-strength epoxy resins and adhesives for metal-to-metal bonding and Honeycomb sandwich construction. .... 45

**BY-PASS ROTAMETER**—Brooks Rotameter Co., Lansdale, Pa. Bulletin 116, describing the company's rotameter, designed to permit economical measurement of large fluid flow rates in pipe sizes of 2 inches and above. .... 46

**BRUSH-FINISHING MACHINE**—Osborn Mfg. Co., Cleveland, Ohio. 20-page catalogue entitled "Brushmatic, How to Improve Finishing the Osborn Way," covering the complete story of the company's Brushmatic finishing machine. .... 47

**GENERAL-PURPOSE PRESS**—Watson-Stillman Press Division, Farrel-Birmingham Co., Inc., Roselle, N. J. 4-page bulletin describing the design features and specifications of the company's 150-ton hydraulic general-purpose press. .... 48

**GRINDING WHEEL ADAPTERS**—Wm. Sopko & Sons Co., Euclid, Ohio. 8-page catalogue featuring the company's complete line of grinding wheel adapters and tool-room and grinding-room accessories. .... 49

**THERMOSTATS**—Stevens Mfg. Co., Inc., Mansfield, Ohio. Bulletin 5000, describing the company's line of Stemco Type C thermostats. Both hermetically sealed and semi-enclosed types are covered. .... 50

**REMOTE-POSITIONING CONTROLS**—Jordan Co., Inc., Milwaukee, Wis. Bulletin J-100, covering the company's electrical, remote-positioning controls for both push-button and automatic operation. .... 51

**PLEASE SEND US MORE INFORMATION.** Circle below item numbers on which you wish further information.

**CATALOGUES**

1 2 3 4 5 6 7 8 9 10 11 12 13 14  
15 16 17 18 19 20 21 22 23 24 25 26 27 28  
29 30 31 32 33 34 35 36 37 38 39 40 41 42  
43 44 45 46 47 48 49 50 51

**NEW SHOP EQUIPMENT**

101 102 103 104 105 106 107 108 109 110 111 112 113 114  
115 116 117 118 119 120 121 122 123 124 125 126 127 128  
129 130 131 132 133 134 135 136 137 138 139 140 141 142  
143 144 145 146 147 148 149 150 151 152 153 154 155 156  
157 158 159 160 161 162 163 164 165 166 167 168

**ADVERTISED PRODUCTS**

Page ..... Advertiser .....  
Page ..... Advertiser .....  
Page ..... Advertiser .....  
Page ..... Advertiser .....

Please print your name and address

**ADVERTISED PRODUCTS**

Page ..... Advertiser .....  
Page ..... Advertiser .....  
Page ..... Advertiser .....  
Page ..... Advertiser .....

**PLEASE SEND US MORE INFORMATION.** Circle below item numbers on which you wish further information.

**CATALOGUES**

1 2 3 4 5 6 7 8 9 10 11 12 13 14  
15 16 17 18 19 20 21 22 23 24 25 26 27 28  
29 30 31 32 33 34 35 36 37 38 39 40 41 42  
43 44 45 46 47 48 49 50 51

**NEW SHOP EQUIPMENT**

101 102 103 104 105 106 107 108 109 110 111 112 113 114  
115 116 117 118 119 120 121 122 123 124 125 126 127 128  
129 130 131 132 133 134 135 136 137 138 139 140 141 142  
143 144 145 146 147 148 149 150 151 152 153 154 155 156  
157 158 159 160 161 162 163 164 165 166 167 168

**ADVERTISED PRODUCTS**

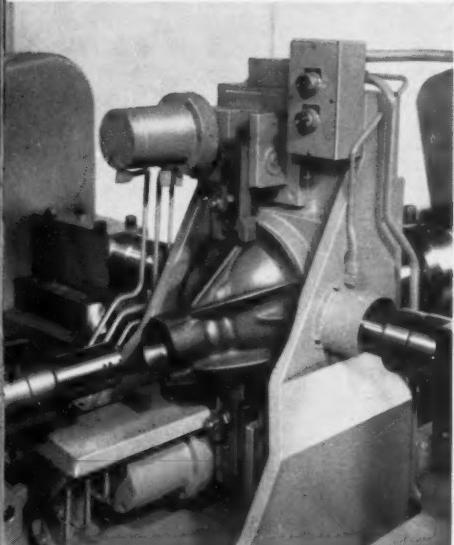
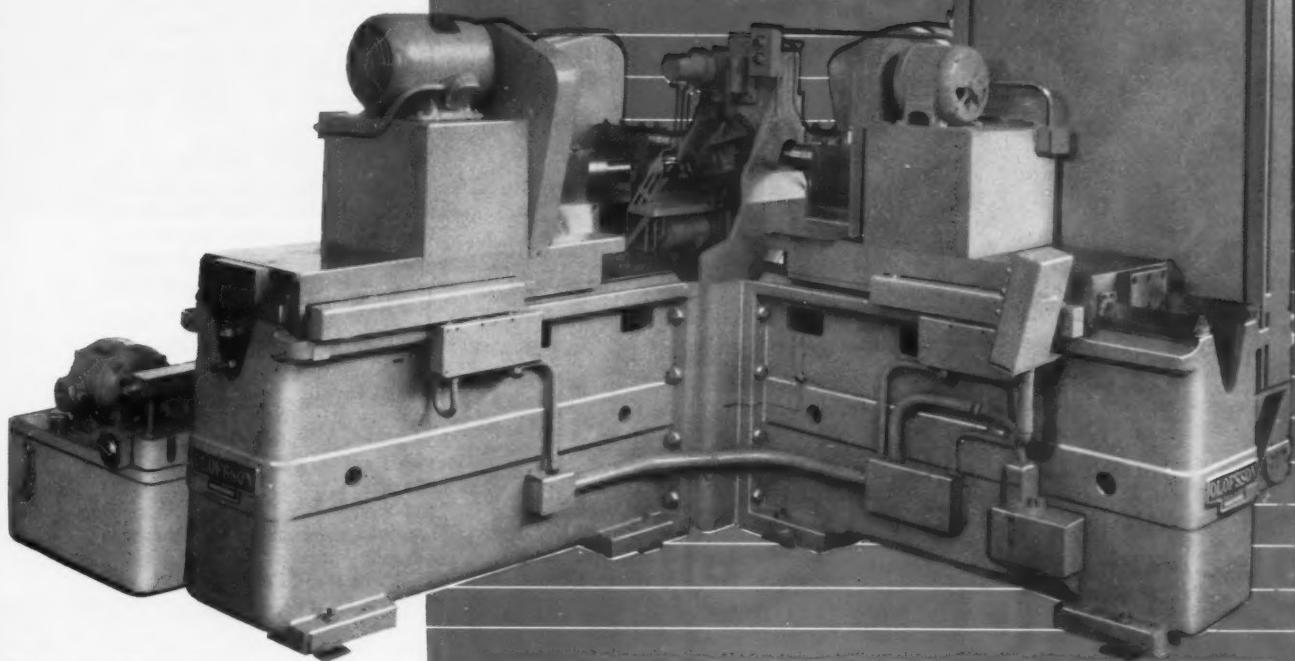
Page ..... Advertiser .....  
Page ..... Advertiser .....  
Page ..... Advertiser .....  
Page ..... Advertiser .....

Please print your name and address

NAME .....  
TITLE .....  
COMPANY .....  
CO. ADDRESS .....  
CITY ..... ZONE ..... STATE .....

NAME .....  
TITLE .....  
COMPANY .....  
CO. ADDRESS .....  
CITY ..... ZONE ..... STATE .....

**OLOFSSON 4-Way Machine**  
precision bores 4 holes  
simultaneously. Holds 90° angles  
and diameters to .000 5".



Close-up view of differential carrier, hydraulically cam-clamped in position for boring.

**for MORE production and  
precision, combine 1, 2, 3, or 4  
OLOFSSON way units in  
any COMBINATION**

OLOFSSON Precision Way Machines perform fast, accurate boring, facing, turning, grooving, and chamfering. Units are electrically interlocked, and the spindles move to the work.

For long, dependable, and accurate operation Olofsson Way Units feature:

- Single push-button control panel.
- Hardened and ground V-style ways.
- Hydraulic control Valves, manifold mounted and located with reservoir.
- Parker Majestic precision boring spindle.
- Rigid ribbed, nickel iron base.
- Adherence to latest J.I.C. recommendations.
- Hydraulic pump units located outside base.
- Automatic central lubrication system.
- Dwell time not affected by positive stop screw adjustment.

FOR COMPLETE INFORMATION WRITE OLOFSSON CORPORATION  
OR PHONE LANSING, MICHIGAN 4-5381.



**THE  
LOFSSON CORPORATION**  
2729 LYONS AVENUE • LANSING, MICHIGAN

MANUFACTURERS OF  
PRECISION BORING  
MACHINES AND  
SPECIAL MACHINERY



(Left) E. L. Oehling, general sales manager, and (right) R. J. Lindsey, vice-president in charge of engineering of the Hydraulic Press Mfg. Co., a division of Koehring Co.



**HYDRAULIC PRESS MFG. CO.**, a division of Koehring Co., Mount Gilead, Ohio, announces the following appointments: E. L. OEHLING has been promoted to general sales manager, and R. J. LINDSEY was named vice-president in charge of engineering. Mr. Oehling succeeds Mr. Bennett as general sales manager. Mr. Lindsey was formerly director of engineering.

**HARRY L. JENTER**, Cleveland district manager of operations for American Steel & Wire Division, has been named vice-president — operations of this division of the United States Steel Corporation. Mr. Jenter succeeds Mr. Leichliter, whose ap-

pointment as Wire Division president was recently announced.

**BERNARD S. RECKSEIT** has been appointed chief engineer of RANSOHOFF, INC., Hamilton, Ohio.

**A. H. SCHOTT** has been appointed general manager of the Crankshaft and Camshaft Division of the Ohio Crankshaft Co., Cleveland, Ohio. Since joining the company as supervisor of inspection in 1941, Mr. Schott has held a number of important positions as chief process engineer, master mechanic, and factory manager. He served as supervisor of inspection for the Hickok Electrical Instrument Co. for two years before coming to Ohio Crankshaft.



Photo "Parade"

**Harry L. Jenter**, vice-president of operations, American Steel & Wire Division, United States Steel Corp.



**A. H. Schott** newly appointed general manager of the Crankshaft and Camshaft Division of Ohio Crankshaft Co.

## Pennsylvania and Delaware

**ROBERT E. BUCKHOLDT** has been appointed manager of engineering for the Selas Corporation of America, Dresher, Pa. In his new position, Mr. Buckholdt will be responsible for the company's furnace and oven designs and engineering applications as related to the steel, metalworking, glass, ceramic, and virtually every industry.

**JAMES H. BRAY** has been appointed manager of the Roll Department of Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. He will be responsible for sales and service in the Eastern, Buffalo, and Canadian steel districts.

**HAMILTON DIVISION** of Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. announces the following appointments: **ALFRED L. STOOPS** has been appointed press sales engineer, and **OWEN J. ROBERTS** has been named press service manager. Mr. Stoops will handle sales of Hamilton mechanical and Baldwin hydraulic presses in northeastern Ohio, western Pennsylvania, and West Virginia.

**ALLEGHENY LUDLUM STEEL CORPORATION** Pittsburgh, Pa., announces the addition of two salesmen to its Seattle, Wash., district sales office. They are: **HARVEY B. LUCAS** and **JOHN H. SNEDEKER**.

**KENNAMETAL INC.** has begun full-scale production in a new plant just completed near Latrobe, Pa. The plant houses the special products grinding department.

**CHARLES E. KNOX** has been appointed manager of the newly created Spring Division of the Crucible Steel Company of America, Pittsburgh, Pa.

**PROCTOR ELECTRIC CO.**, Philadelphia, Pa., has increased manufacturing and warehousing facilities in its Maryland plant by 50,000 square feet.

**ROBERT B. KRAMER** has been appointed plant manager of the Page Steel & Wire Division, American Chain & Cable Co., Inc., Monessen, Pa.

**LEWIS M. CROWE CO.**, Atlanta, Ga., has been appointed sales representative for **CONOFLOW CORPORATION**, Philadelphia, Pa.

**V. W. WELLS** has been elected vice-president of the Electric Hose & Rubber Co., Wilmington, Del.

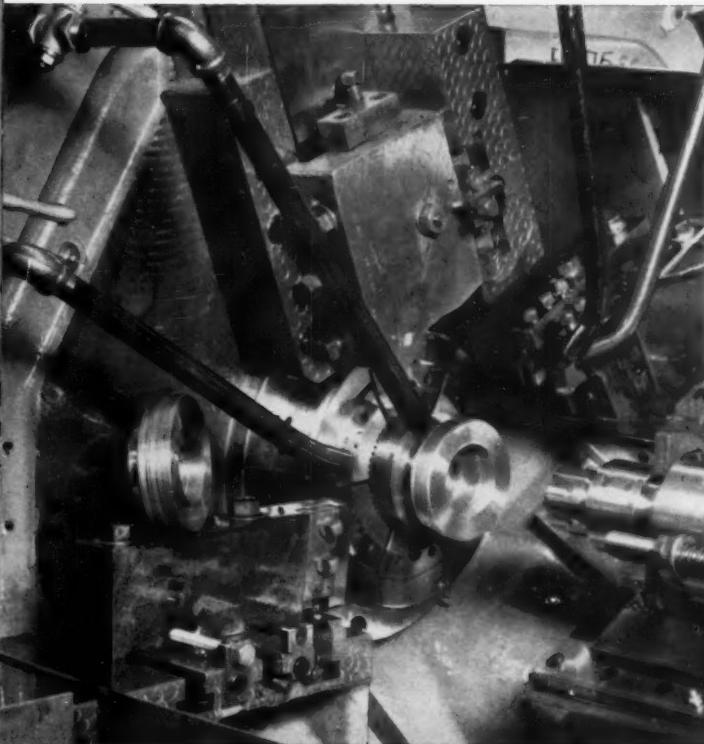
# Acme-Gridley

**fully automatic turret lathe . . . gives you  
increased production in inverse ratio to cost**

This customer chose a model MR Acme-Gridley to produce this packing gland nut, because he was able to increase his production by more than 3 times that of the former method.

The Acme-Gridley automatically controlled cycle is predetermined to give the minimum time per piece, on *every* piece. Because each tool-slide is independently cammed and selective spindle speeds are automatically controlled, machining can be done at the surface speed best suited for required finish and tolerance.

WRITE today for your free copy of new Bulletin MR-56. See why Acme-Gridley Basic Design lets you increase production and lower unit costs.





**JOB FACTS**

Packing Gland Nut  
from 4 $\frac{1}{4}$ " round  
1112 C.D. Steel.

12 Operations (with 9 tools) including threading and tapping.

Former Method produced 409 pieces in 192 hours on hand operated machine.

On Model M Acme-Gridley—325 pieces in 48 hours.

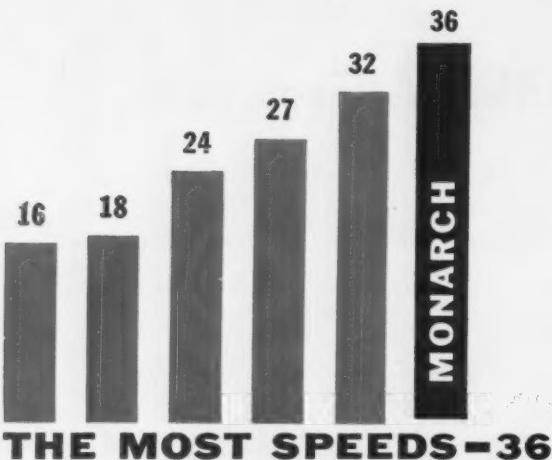
Savings—7 to 2 production increase at better than 3 to 1 savings in cost per piece.

## National Acme

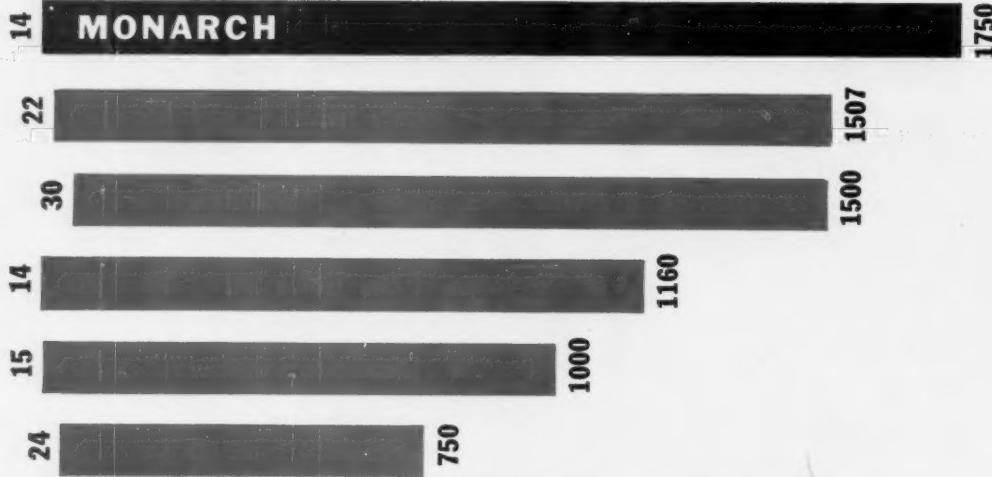
THE NATIONAL ACME COMPANY, 179 EAST 131ST STREET, CLEVELAND 8, OHIO

# TALK ABOUT SPEEDS!

There's No Matching the Monarch Preselector Dyna-Shift



Unique Speed  
PRESELECTOR  
DYNA-SHIFT



**Surface Cutting Speed!** These three words are the key to top efficiency in the operation of any lathe.

Certainly it's true, you say. But why bring that up? Because only now is a lathe available to give you, practically the correct surface speed, diameter after diameter, piece after piece. That lathe is the new Monarch Series 62 Preselector Dyna-Shift.

It has 36 speeds in a range of 14 to 1750 RPM. Headstock ratio is 125 to 1. And it has *speed preselection*. Here at last is a machine with a standard speed range low enough, high enough and with plenty of speeds in between to make unnecessary a whole assortment of special ranges. With this one standard range you have the power to turn efficiently any part within the work capacity of the lathe.

The Dyna-Shift feature makes it unnecessary for the operator ever to figure the R.P.M. he needs for the desired surface speed. He never has to be a calculating machine. He never has to get bleary-eyed

figuring a lever setting combination from a complex index plate. He never has to be a color matcher. He never has to set a series of levers in a variety of positions as indicated by the index plate.

All he does is set two large dials on the Preselector Dyna-Shift—one for the work diameter to be turned, the other for the surface speed needed. The machine calculates the necessary R.P.M. and makes the shift automatically. With the preselection feature he may preset up to 6 or more different diameters and set up the shift for each while the machine is turning the previous diameter.

Nowhere but on the Monarch Series 62 Preselector Dyna-Shift can you get this combination. And no other machine can be kept under full load during the entire machining cycle for the utmost in metal removing efficiency. There's an area of cost reduction you cannot afford to overlook any longer. Ask us about it. *The Monarch Machine Tool Co., Sidney, Ohio.*

**MONARCH**

**125**

**89**

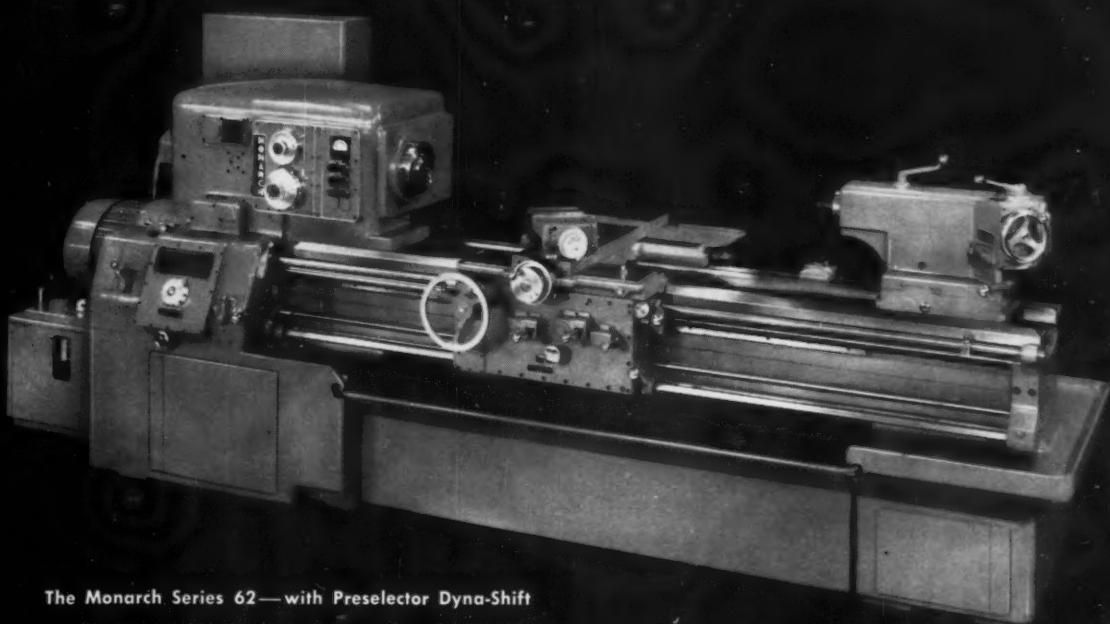
**73**

**71**

**46**

**32**

**GREATEST RATIO—125 to 1**



The Monarch Series 62—with Preselector Dyna-Shift

### **PRODUCTION PLUS**

#### **The Monarch Series 62**

**Increases Productivity up to 25%\***  
**Increases Tool Life up to 50%\***

\*Figures based on studies comparing step shaft output of Preselector Dyna-Shift with that of a conventional 16-speed headstock lathe.

**Monarch**  
TURNING MACHINES  
ACCURACY • ECONOMY • LONG LIFE • ADAPTABILITY

#### **THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio**

Gentlemen:

- I am interested in your Series 62 story. Please send me your illustrated Booklet #1505 with complete data.  
 Please have a Monarch sales engineer call on me.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



Scott Wipers are soft, absorbent 2-ply paper sheets. Plies are welded together for greater strength. They're chemically treated for excellent wet strength. Special perf-embossed surface is ideal for picking up liquid or powder—for cleaning tools, stock, machines, hands and face.

## **WIPER PROBLEM? Look what Mennen did with Scott Wipers!**

For 75 years, The Mennen Company, Morristown, N. J., has adopted the latest ideas in production, cleanliness and sanitation. That's why they got rid of rags, switched to Scott Wipers.

Scott Wipers are installed at every machine. They're easily disposed of. No clinging metal chips on Scott Wipers fresh from the box, so less chance of cuts and scratches on hands and face. At Mennen, they're used

throughout the plant—including the machine shop. Here, they wipe machines, tools, stock, fine micrometers.

Tired of the "wiper problem"? Tired of high unit cost, expensive handling, shrinkage, and losses? Do as Mennen and many other manufacturers have done: call your local Scott representative or distributor. Or write Scott Paper Company, Department M-71, Chester, Pa.



### **SCOTT PAPER COMPANY**

Makers of the famous Scott paper products you use in your home.  
Consult your local TV schedules for Scott's program, "Father Knows Best."

## New Books and Publications

**MACHINE TOOL LEASING.** By J. L. Treynor and Richard F. Vancil. 8 1/4 by 11 inches. Published by Management Analysis Center, Inc., 275 Mulberry St., Boston, Mass. Price \$15.

The initial chapters of this book deal with the history, background, and rapid growth of machine tool leasing, and the impact of income taxes on buy-or-lease decision is the subject of a separate chapter. Particular emphasis is placed on the fact that while leasing does accelerate the cost deductions for federal income tax purposes, this does not, by itself, mean that leasing is necessarily advantageous to the lessee.

As preliminary to a discussion of the cost aspects, a chapter is devoted to an explanation of two important concepts—"The Desired Earnings Rate" and "Present Value." Although the treatment is in accordance with sound economic thinking, the ideas are presented in nontechnical language, and fully worked out examples are used to show the practical application of these concepts.

**AMERICAN STANDARD LIFE TESTS FOR SINGLE-POINT TOOLS OF SINTERED CARBIDE (ASA B5.34-1956).** 6 pages, 8 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price \$1.

**AMERICAN STANDARD DESIGN FOR FINE - PITCH WORMGEARING (AGMA 374.03 ASA B6.9-1956).** 20 pages, 8 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, \$1.50.

**FUNDAMENTALS OF VIBRATION ANALYSIS.** By N. O. Myklestad. 6 by 9 inches, 260 pages. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, \$6.50.

The objective of this book is to give the reader a thorough understanding of the subject of vibrations from a basic point of view rather than by presenting routine methods of analysis. Since only the calculus methods of analysis are used in such a way that a clear picture of the phenomena is brought out, numerical and routine methods of analysis are reduced to a minimum. After these fundamentals have been

mastered, the reader will be able to go on to study numerous special tools that have been developed for the purpose of obtaining solutions to more complicated problems. Designed for a first course in vibration analysis at either the undergraduate or graduate level, this book will be of value to the practicing engineer either as a reference or for self-instruction.

**ELECTRONICS IN INDUSTRY.** By George M. Chute. 6 by 9 inches, 431 pages. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, \$7.50.

This book presents the fundamentals of electronic devices as needed by men in industry and explains how these devices are used in practical circuits. The uses of vapor or gas tubes are stressed. Several laboratory instruments are discussed, as well as the many non-electronic devices often used in electronic equipment. There is little use of mathematics beyond simple arithmetic problems. Tubes are introduced gradually in simple operating circuits to acquaint the reader with the purpose of electronic equipment while briefly exploring the nature of the tubes themselves.

**SYMPOSIUM ON HIGH-PURITY WATER CORROSION (ASTM Special Publication 179).** 6 by 9 inches, 56 pages. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. Price, \$1.75.

Rising concern with corrosion problems makes this symposium of interest to corrosion engineers, nuclear engineers, and scientists interested in the phenomena associated with high-purity water and its corrosive effect under various conditions. The booklet is generously and clearly illustrated with graphs, diagrams, and a number of photographs.

**PROPOSED AMERICAN STANDARD NATIONAL MINIATURE SCREW THREADS (ADA B1.4).** Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

This standard is now in preparation. Interested parties may obtain

copies of the tentative draft free of charge by addressing Frank Philippo, Standards Department at the above address.

## Coming Events

**MARCH 11-15**—NUCLEAR CONGRESS to be held at the Convention Hall, Philadelphia, Pa., under the coordination of the Engineers Joint Council. Peacetime uses of atomic energy will be the topic of this Congress. Further information can be had from the Engineers Joint Council, 29 W. 39th St., New York 18, N. Y.

**MARCH 11-15**—International Atomic Exposition in conjunction with the 1957 Nuclear Congress to be held in the Philadelphia Convention Hall. Foreign firms and governments wishing to participate may get complete information from the nearest United States consulate or legation, or direct from the Exposition Offices, International Atomic Exposition, Inc., 304 Architects Building, Philadelphia, Pa.

**MARCH 25-27**—Silver Anniversary, Technical Meeting, and Convention of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Shamrock Hilton Hotel, Houston, Tex., will include symposiums on ceramic and plastic tooling, technical papers, and panels. Program Director L. S. Fletcher, 10700 Puritan Ave., Detroit 38, Mich.

**MARCH 25-29**—Tenth Western Metal Exposition and Congress, sponsored by the AMERICAN SOCIETY FOR METALS and other technical groups to be held at the Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif. Managing Director W. H. Eisenman, 7301 Euclid Ave., Cleveland, Ohio.

**APRIL 9-11**—Fifth Welding Show and Industrial Exposition sponsored by the AMERICAN WELDING SOCIETY to be held at Convention Hall, Philadelphia, Pa. Advance registration tickets and hotel information may be obtained from Robert T. Kenworthy, exposition management, 12 E. 41st St., New York 17, N. Y.

**APRIL 29-MAY 3**—Seventh National Materials Handling Exposition to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.



## Shopworn Drawings Replaced Photographically

A photographic reproduction system that can both improve most worn and smudged drawings and also produce sharp, clear, distortion-free second originals has been developed by Micro-Master, Inc., Kansas City, Mo., in association with Keuffel & Esser Co., Hoboken, N. J. Based on a 105-millimeter negative, Micro-Master is being offered as a reproduction service throughout the United States and Canada. Drawings in sheet sizes as large as 36 by 54 inches, and even larger in roll lengths, can be duplicated.

Tracings to be reproduced are mounted on a vacuum easel and photographed to pick up maximum detail. Normally, soiled copy requires an exposure adjustment to burn out the background which, in turn, also burns out any weak lines. In this new system, however, the weakest line image is captured without respect to background dirt.

The negative, Fig. 1, is a faithful reproduction of the original, showing all the ragged edges, tape mends, erasures, etc. As a result of a unique optical system in the equipment and a precise processing technique, most of these unwanted marks are eliminated from

the print, Fig. 2. Drawings that are virtually illegible to the naked eye become perfectly readable in the second original. This is because the carbon pencil lines on the first drawing are replaced with darker, sharper, silver-com-

Fig. 1. (Left) Negatives to be printed are mounted in carriers that slide into a projector designed exclusively for line work. The control panel shown in the lower left-hand corner is capable of timing exposures to the nearest one-tenth of a second to eliminate any unwanted background.

Fig. 2. (Below) Reproductions are precisely controlled. Special chemical formulas are used for developing and fixing both negatives and prints to provide a perfect image, free of pin-holes, of all line work.

pound lines without picking up background deficiencies of the paper base.

The Micro-Master line includes fully engineered screen projectors, table-top viewers, and large viewing tables for drafting-room use. With the viewing table, full-scale tracings or adaptations of existing tracings can be made from an enlarged negative.

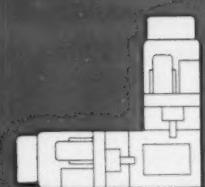




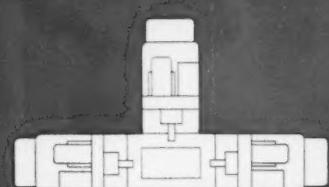
ONE WAY



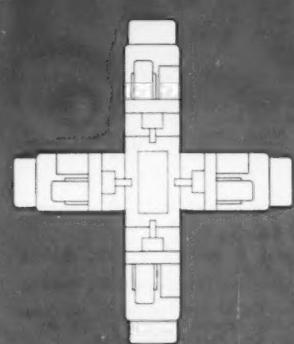
TWO WAYS AT 180°



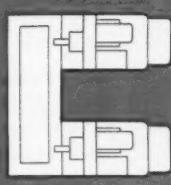
TWO WAYS AT 90°



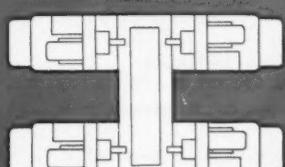
THREE WAYS



FOUR WAYS



MULTI-WAYS



MULTI-WAYS



Ex-Cell-O 4-Way Machine precision bores four holes simultaneously, holding 90° angles.

## 7 ways to increase your production

**Three new features on all Ex-Cell-O Way Machines give even greater production and precision**

The diagrams at left tell a story.

Ex-Cell-O Way Machines using standard components in the combinations illustrated perform precision boring, turning, facing, grooving and chamfering operations economically and quickly. They take large work pieces in stride—the spindles move to the work.

In each machine three new features assure long life, dependable operation, and exceptional accuracy.

The features: (1) ways are hardened and ground, (2) slides are fully supported the length of the stroke, (3) hydraulic control panels give a wide range of automatic cycles.

Write Ex-Cell-O in Detroit for further information. Better still, call in an Ex-Cell-O representative.

EX-CELL-O  
FOR  
PRECISION

**EX-CELL-O**  
CORPORATION

DETROIT 32, MICHIGAN • Manufacturers of Precision Machine Tools • Grinding Spindles • Cutting Tools  
• Railroad Pins and Bushings • Drill Jig Bushings • Aircraft and Miscellaneous Production Parts • Dairy Equipment

# Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

## ABRASIVE CLOTH, Paper and Belt

Crane Packing Co., Morton Grove, Ill.

## ABRASIVES, Discs

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Gardner Machine Co., Beloit, Wis.  
Norton Co., 1 New Bond St., Worcester, Mass.  
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

Norton Co., 1 New Bond St., Worcester 6, Mass.  
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

## ABRASIVES, Polishing, Tumbling, Etc.

Crane Packing Co., Morton Grove, Ill.  
Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.

**ACCUMULATORS, Hydraulic**  
Erie Foundry Co., 1253 W. 12th St., Erie, Pa.  
Farrel-Birmingham Co., Inc., Ansonia, Conn.

## AIR GAGES, Dimensional—See Gages Air Comparator

## AIR GUNS

Chicago Pneumatic Tool Co., New York 17, N. Y.  
Schroeder's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

## AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

## ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Carpenter Steel Co., Reading, Pa.  
Columbia Tool Steel Co., Chicago Hts., Ill.  
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.  
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.  
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.  
Vanadium Alloys Steel Co., Latrobe, Pa.  
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

## ALLOYS, Bearing

Bunting Brass & Bronze Co., 715 Spencer Toledo 1, Ohio.  
Carpenter Steel Co., 105 W. Barn St., Reading, Pa.  
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.  
Mueller Brass Co., Port Huron, Mich.

## ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

## ALUMINUM and Aluminum Products

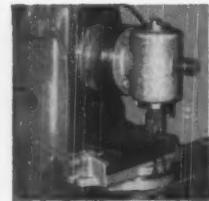
Bridgeport Brass Co., Bridgeport, Conn.  
Mueller Brass Co., Port Huron, Mich.  
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.  
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

## ANGLE PLATES—See Set-Up Equipment

## ANNEALING FURNACES

Eisler Engng. Co., 750 So. 13th St., Newark 3, N. J.  
General Electric Co., Schenectady, N. Y.

(Continued on page 248)



Heavy Duty Vertical Milling Attachment



Heavy Duty Offset Vertical Milling Attachment



Universal Milling Attachment



Rack Milling Attachment

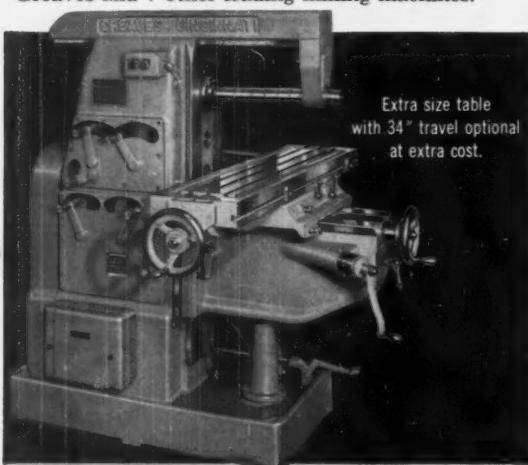
Send coupon for  
FREE Comparison  
Chart and detailed  
descriptive literature  
on easy-to-use  
attachments.

## Heavy duty attachments increase versatility of dependable, low-cost

## GREAVES MILLS

"THE MOST MILL FOR THE LEAST MONEY"

A full line of attachments and accessories offer outstanding flexibility for all types of milling operations . . . with GREAVES MILLS.  
Make your own comparison of 22 specifications of Greaves and 7 other leading milling machines.



Extra size table  
with 34" travel optional  
at extra cost.

**GREAVES MACHINE TOOL CO.**  
2500 Eastern Avenue, Cincinnati 2, Ohio  
Send Comparison Chart. I will make my own comparison of GREAVES MILLS with other makes.  
Send information on Attachments and Accessories for GREAVES MILLS.

|         |            |
|---------|------------|
| NAME    | TITLE      |
| FIRM    |            |
| ADDRESS |            |
| CITY    | ZONE STATE |



*Illustrated—Logansquare Cylinder.*

# Look to Logan

**the ultimate in air cylinder design**

**the ultimate in air cylinder design**



**FREE** SEND FOR THE "LOGAN CALCULATOR"

A gift to you from Logansport Machine Company upon request.

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

**LOGANSPORT MACHINE CO., INC.**  
**810 CENTER AVENUE, LOGANSPORT, INDIANA**

PLEASE SEND COPY OF CATALOG:

- PLEASE SEND COPY OF CATALOG:**

  - 100-1 AIR CYLINDERS
  - 100-2 MILL-TYPE AIR CYLS.
  - 100-3 AIR-DRAULIC CYLS.
  - 100-4 AIR VALVES
  - 100-5 LOGANSQUARE CYLINDERS
  - 100-5-1 UTRALUMINATION CYLINDERS
  - 51 PRESSES
  - FACTS OF LIFE
  - 62 SURE-FLOW PUMPS
  - 200-1 HYD. POWER UNITS
  - 200-2 ROTOCAST HYD. CYLINDERS
  - 200-3 750 SERIES HYD. CYLINDERS
  - 200-4 and 200-7 HYD. VALVES
  - 200-6 SUPER-MATIC CYLS.
  - 70-1 CHUCKS
  - ABC BOOKLET

CIRCUIT RIDER

TO:

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

**COMPANY** \_\_\_\_\_

**ADDRESS** \_\_\_\_\_



## GOSS and DE LEEUW CHUCKING MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.



Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

### GOSS and DE LEEUW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



#### ARBOR PRESSES—See Presses Arbor

#### ARBORS AND MANDRELS

Brown & Sharpe Mfg. Co., Providence, R. I.  
Chicago-Latrobe Twist Drill Works, 411 W.  
Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland, Ohio.  
Jacobs Mfg. Co., West Hartford, Conn.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
Logansport Mch. Co., Inc., Logansport, Ind.  
South Bend Lathe Wks., South Bend 22, Ind.  
Supreme Products, Inc., 2222 So. Calumet Ave.,  
Chicago 16, Ill.  
Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.  
Whitman & Barnes, 40600 Plymouth Rd.,  
Plymouth, Mich.

#### ARC WELDERS—See Welding Equipment, Arc

#### AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

#### BABBITT

American Crucible Products Co., Lorain, Ohio.  
Ryerson, Jos. T. & Son, 2558 W. 16th St.,  
Chicago 18, Ill.

#### BALANCING EQUIPMENT

Gisholt Machine Co. Static and Dynamic,  
1245 E. Washington Ave., Madison 10, Wis.  
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit  
34, Mich.  
Sandstrand Mach. Tool Co., 2531 11th St.,  
Rockford, Ill.

#### BALL-MAKING MACHINES

Haynes Stellite Co., Kokomo, Ind.  
New Departure Div., Bristol, Conn.

#### BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

#### BAR STOCK, Non-ferrous

American Crucible Prod. Co., Port Huron,  
Mich.  
Bunting Brass & Bronze Co., 715 Spencer,  
Toledo, Ohio.  
Centrifugally Cast Products Div., Shenango  
Furnace Co., Dover, Ohio.  
Mueller Brass Co., Port Huron, Mich.  
Ryerson, Jos. T. & Son, 2558 W. 16th St.,  
Chicago 18, Ill.

#### BAR STOCK AND SHAFTING, Steel

Bethlehem Steel Co., 701 East Third St.,  
Bethlehem, Pa.  
Boston Gear Works, 14 Hayward St., Quincy  
71, Mass.  
Carpenter Steel Co., 105 W. Bern St., Reading,  
Pa.  
Crucible Steel Co. of America, Henry W.  
Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.  
Cumberland Steel Co., Cumberland, Md.  
Ryerson, Jos. T. & Son, 2558 W. 16th St.,  
Chicago 18, Ill.

#### BEARING PILLOW BLOCKS AND CARTRIDGES

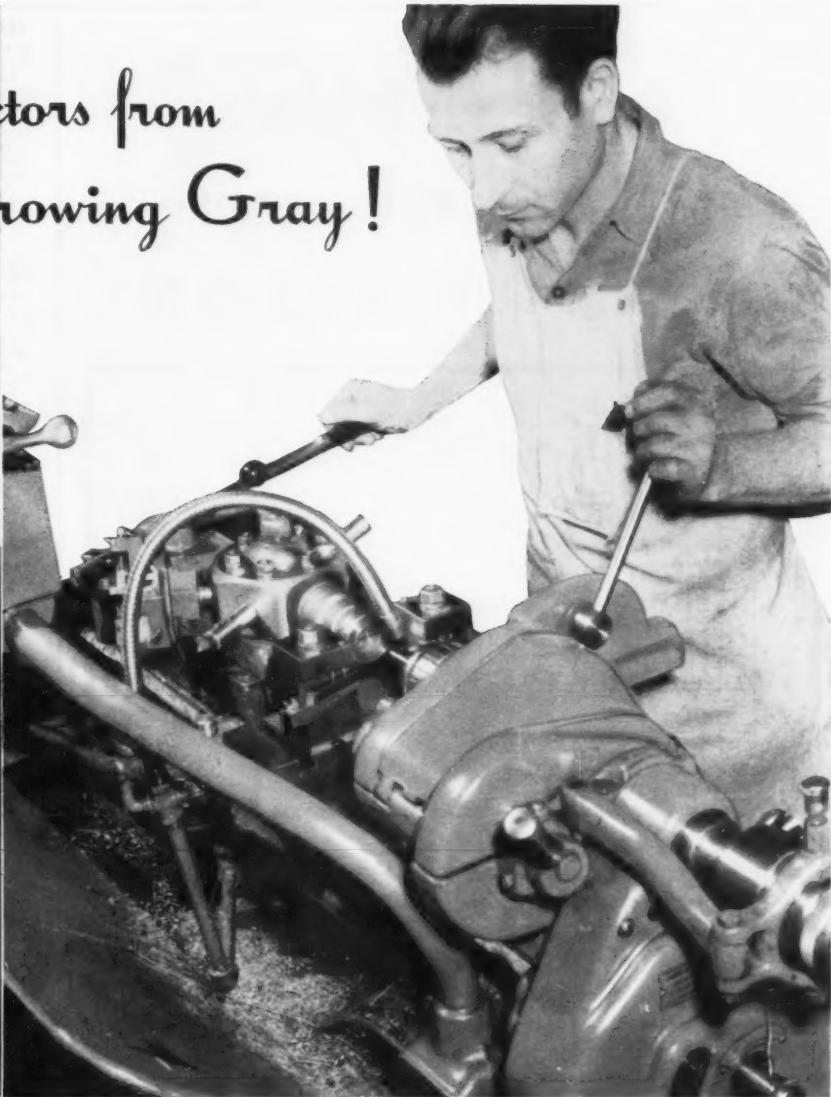
Fafnir Bearing Co., New Britain, Conn.

(Continued on page 250)

# Keep Inspectors from Growing Gray!



**SOUTH  
BEND  
10"  
PRECISION  
TURRET  
LATHE**



Put this precision turret lathe to work on your small, exacting jobs and you'll save yourself a lot of trouble. You'll find that even the tough tolerances can be held without sacrificing output to do it. Extremely versatile, easily and quickly tooled for a wide variety of work. Operators find it exceptionally smooth to handle. *Send now for complete information.*

**SPECIFICATIONS:** Swing 10 $\frac{1}{2}$ " • Collet capacity 1" • Spindle bore 1 $\frac{3}{8}$ " • Turret slide travel 4"  
• Spindle to turret 19 $\frac{3}{8}$ " max. • Spindle speeds 12 or 24 • Turning, facing, threading feeds for carriage, 70 each..... **Prices start at \$1665**

**SOUTH BEND LATHE**—Builders of lathes, milling machines, shapers, drill presses, pedestal grinders.



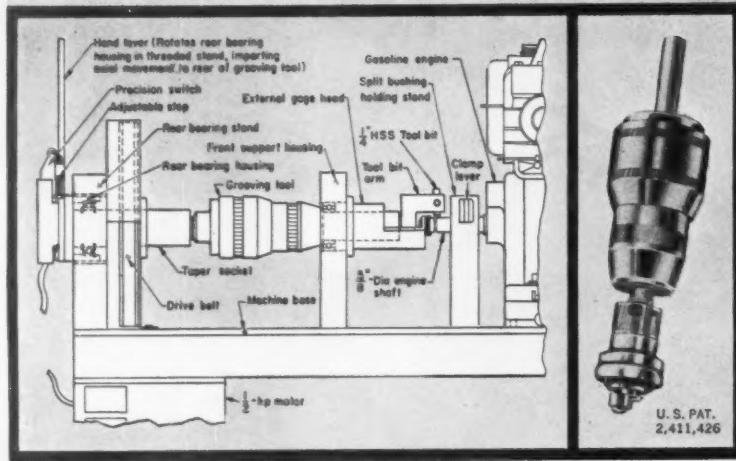
**South Bend Lathe, South Bend 22, Indiana:** Send information on—10" Turret Lathes,—13" and 16" Turret Lathes, —Engine and Toolroom Lathes, —Milling Machines, —Drill Presses, —Pedestal Grinders.

NAME \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

# Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



To install a small gear, Clemson Bros. must machine a recess (Tolerance:  $+.033" - .000"$ ) in a shaft of the engine for their power lawn mowers. Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving. All this costly time and labor was eliminated by holding the shaft stationary

and using a tool that rotates—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool.



## BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.  
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Fafnir Bearing Co., New Britain, Conn.  
Federal Bearings Co., Inc., Poughkeepsie, New York  
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.  
New Departure Div., Bristol, Conn.  
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.  
Norma-Hoffman Bearings Corp., Stamford, Conn.

## BEARINGS, Bronze and Special Alloy

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.  
Boston Gear Works, 3200 Main St., North Quincy, Mass.  
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.  
Shenango-Penn Mold Co., Dover, Ohio.

## BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

## BEARINGS, Oilless

American Crucible Prod. Co., Lorain, Ohio.  
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.  
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

## BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.  
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.  
Norma-Hoffman Bearings Corp., Stamford, Conn.  
Orange Roller Bearing Co., Inc., Orange, N. J.  
Railway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.  
Timken Roller Bearing Co., Canton, Ohio.

## BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.  
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.  
Fafnir Bearing Co., New Britain, Conn.  
General Electric Co., Schenectady, N. Y.  
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.  
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.  
Norma-Hoffman Bearings Corp., Stamford, Conn.  
Orange Roller Bearing Co., Inc., Orange, N. J.  
Railway Bearing Co., Inc., Syracuse, N. Y.  
Shenango-Penn Mold Co., Dover, Ohio.  
Timken Roller Bearing Co., Canton, Ohio.

**BELT SANDERS**—See Grinding Machines,  
Abrasives Belt

## BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

## BENCH CENTERS

Brown & Sharpe Mfg. Co., Providence, R. I.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

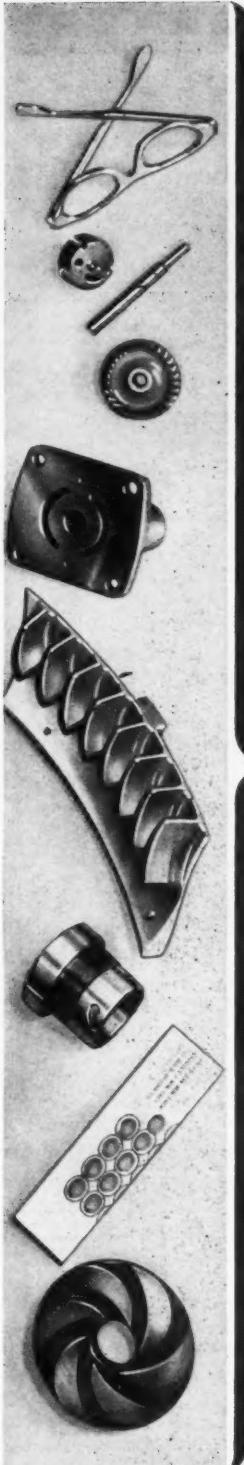
## BENCHES AND STOOLS

South Bend Lathe Works, South Bend 22, Ind.

## BENDERS, Bar, Tube, Channel, etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.  
Greenlee Bros. & Co. 2136—12th St., Rockford, Ill.

(Continued on page 252)



A few examples  
of work  
produced on  
Gorton  
Pantographs  
at  
substantial  
savings  
in time  
and money



**240 PIECES PER HOUR**  
This fuse part, of No. 1213 steel, has a serpentine groove with irregular radii. Two pantograph cutters rough out and the other two finish parts in pairs. Groove is .1903" wide, plus .0014", by .109" deep, plus .003". Finish: 35 mic.

## GORTON *Multiple Pantographing*

**Volume Production • Precision Tolerances**

**Tool room accuracy with production line speed is characteristic of Gorton Pantographs.** These versatile machines will turn out a dozen . . . or a million . . . finished pieces from one setting with no perceptible variation in required tolerances. From two to six different operations can be performed at each setting with all operations completely automatic within the cutting cycle. In fact, output is limited only by the capacity of the cutter. Spindles turn at 900 to 45,000 RPM providing infinitely variable cutting speeds and feeds.

Shape of part matters little. Two or three-dimensional cutting can be performed on flat, cylindrical, spherical, square or irregularly shaped work. 16 Pantograph models cover a wide range of applications in profiling, grooving, slotting, milling, chamfering, graduating, counter boring, die sinking, mold making, routing, engraving, grinding, burnishing and etching. Models provide manual, semi-automatic and fully automatic cycling. Custom built.

Write for Bulletins 1655, 2595-DS, 2604-DS, 1301



New P1-2  
heavy-duty  
model  
with 3/8" spindle  
capacity  
and 1/2 HP  
motor  
available



**GEORGE GORTON MACHINE CO.**

1301 Racine Street

SINCE 1893

Racine, Wisconsin

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A 8846-1P

For more information fill in page number on Inquiry Card, on page 233

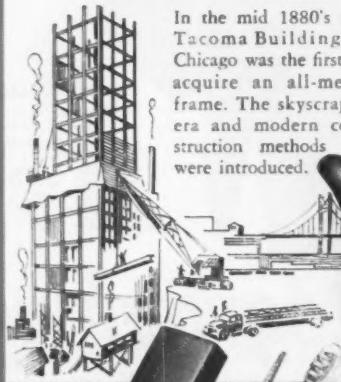
MACHINERY, January, 1957—251

# WILLIAMS

## TOOLS OF INDUSTRY

**FOREMOST! SINCE...**  
the Construction Industry  
adopted the steel skeleton

In the mid 1880's the Tacoma Building of Chicago was the first to acquire an all-metal frame. The skyscraper era and modern construction methods were introduced.



**HOIST HOOKS**  
Proof tested from  $\frac{1}{2}$  to 50 ton capacity

**CARBON WRENCHES**  
31 patterns, 581 sizes,  
openings from  $\frac{3}{16}$ " to  $7\frac{1}{2}$ "

**ALLOY SUPERWRENCHES**  
30 patterns, 365 sizes,  
openings from  $\frac{3}{16}$ " to  $3\frac{1}{2}$ "

**SUPER SOCKETS AND  
ACCESSORIES**  
in five drive sizes,  
openings from  $\frac{3}{16}$ " to  $3\frac{1}{2}$ "



Since 1882, Williams has anticipated the tool requirements of the construction industry...high capacity hooks to hoist girders and machinery...strong, efficient wrenches to bolt them tight.

Today, Williams makes the Broadest Line of Its Kind.

NOTE: You get quickest delivery at lowest cost from your local distributors.

WRITE for Catalog 302 showing the complete Williams line.

**J. H. WILLIAMS & CO.**  
**408 VULCAN STREET, BUFFALO, N.Y.**

BUFFALO • NEW YORK • CHICAGO • LOS ANGELES

### BENDERS, Plate, Etc.

Bath, Cyril Co., 32324 Aurora Road, Solon,  
Ohio.  
Cincinnati Shaper Co., Hopple & Gerrara,  
Cincinnati, Ohio.  
Niagara Mch. & Tool Wks., 637 Northland  
Ave., Buffalo 11, N. Y.

### BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div.,  
Philadelphia 42, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Buffalo Forge Co., 490 Broadway, Buffalo,  
N. Y.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Hannifin Corp., 501 Wolf Rd., Des Plaines,  
Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.  
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo,  
N. Y.  
Niagara Machine & Tool Works, 683 Northland  
Ave., Buffalo, N. Y.  
Verson Allsteel Press Co., 93rd St. & S. Ken-  
wood Ave., Chicago, Ill.

### BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo,  
N. Y.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.

### BENDING ROLLS

Cleveland Punch & Shear Works Co., 3917  
St. Clair Ave., Cleveland, Ohio.  
Niagara Mch. & Tool Wks., 637 Northland  
Ave., Buffalo 11, N. Y.

### BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave.,  
Detroit 38, Mich.  
Pangborn Corp., Hagerstown Md.

### BLOWERS

Buffalo Forge Co., 490 Broadway Buffalo,  
N. Y.

### BLUING LAYOUT

Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

### BLUEPRINT MACHINERY & ACCESSORIES

Wickes Brothers, 512 No. Water St., Saginaw,  
Mich.

### BOLTS, NUTS AND SCREWS

Allen Mfg. Co., 133 Sheldon St., Hartford 2,  
Conn.  
Bethlehem Steel Co., 701 East Third St.,  
Bethlehem, Pa.  
Ottemiller, W. H., & Co., York, Pa.  
Parker-Kalon Div., Clifton, N. J.  
Russell, Burdsall & Ward Bolt & Nut Co.,  
Port Chester, N. Y.  
Standard Pressed Steel Co., Jenkintown, Pa.  
Williams & Co., J. H., 400 Vulcan St.,  
Buffalo 7, N. Y.

### BOOKS, Technical

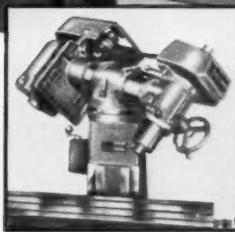
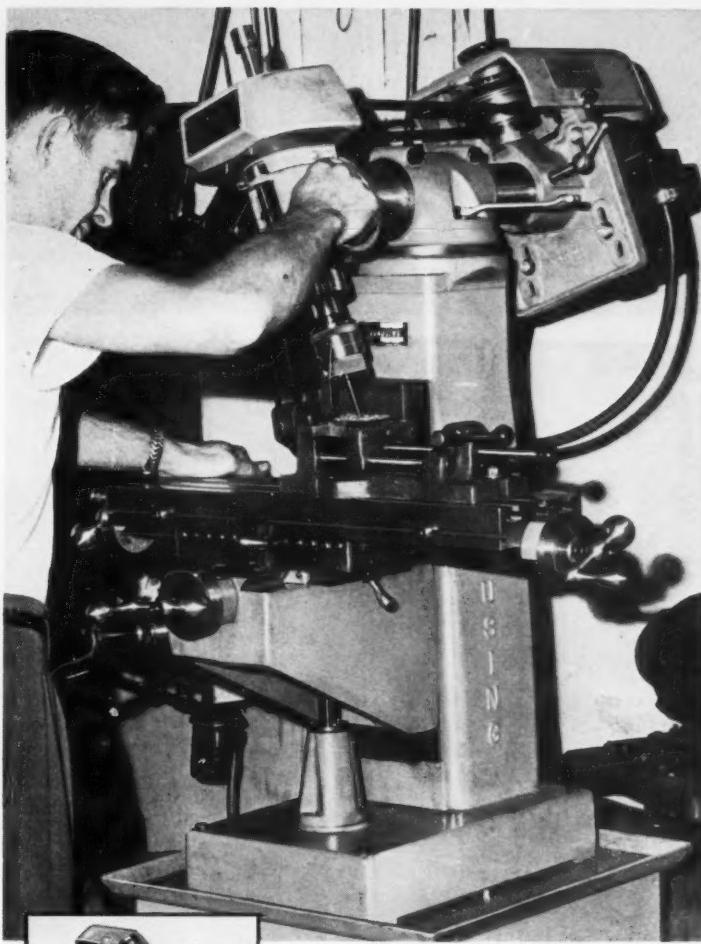
Industrial Press, 93 Worth St., New York 13,  
N. Y.

### BORING BARS

Armstrong Bros. Tool Co., 5200 W. Armstrong  
Ave., Chicago, Ill.  
Bullard Co., 286 Canfield Ave., Bridgeport 6,  
Conn.  
Davis Boring Tool Div., Giddings & Lewis  
Machine Tool Co., Fond du Lac, Wis.  
Delta Power Tool Div., 400 N. Lexington Ave.,  
Pittsburgh 8, Pa.  
Ingersoll Milling Machine Co., 2442 Douglas  
St., Rockford, Ill.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Metallurgical Products Dept. of General Electric  
Co., Box 237 Roosevelt Park Annex,  
Detroit 32, Mich.

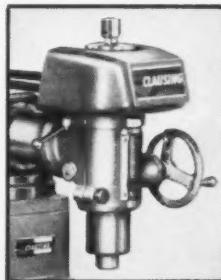
(Continued on page 256)

# "EXCEPTIONAL SENSITIVITY" with the CLAUSING VERTICAL MILL



The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to mill, drill, bore, ream and shape at all angles with one set-up. Quill has micrometer depth control stop and two feeds, lever and hand wheel.

The heart of the CLAUSING MILL is its rigid, high precision spindle head. It has 7 ball bearings . . . spindle is chrome nickel steel, hardened and ground . . . quill, ground and hard chrome plated, has full-length honed bearing seat . . . overarm is an electric furnace casting, with  $\frac{3}{4}$ " thick walls, precision ground.



D & S Tool and Manufacturing Co., widely known for precision tool and die work, reports: "Our men prefer CLAUSING MILLS for die working. They have a sensitivity you don't get in larger machines that really pays off in accuracy and efficiency on every operation using small cutters, and the time they save in job set-ups is substantial."

## MOST ACCURATE MACHINE OF ITS TYPE and CAPACITY

Each CLAUSING Mill must pass these rigid tolerance tests:

1. Top of table perpendicular to column ways, both directions, within .0005" in 8" travel.
2. Table top, front to back, square with column ways 0 to .001".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

## CONDENSED SPECIFICATIONS

|                                    |                    |
|------------------------------------|--------------------|
| Size of Table                      | 6" x 24"           |
| Longitudinal Table Travel          | 15"                |
| Transverse Table Travel            | .5"                |
| Vertical Table Travel              | 11 $\frac{1}{2}$ " |
| Maximum Distance Spindle to Column | 8 $\frac{3}{4}$ "  |
| Quill Travel                       | 3"                 |

Spindle Speeds: Six, 180 to 3250 RPM. No. 7 Brown and Sharpe or No. 2 Morse Taper Spindle Optional. Operates from  $\frac{1}{2}$  or  $\frac{3}{4}$  H.P., 1725 RPM. Motor.

**MILLS, DRILLS, BORES,  
REAMS AND SHAPES  
AT ALL ANGLES WITH  
ONE WORK SET-UP!**

*Write for  
FREE LITERATURE*



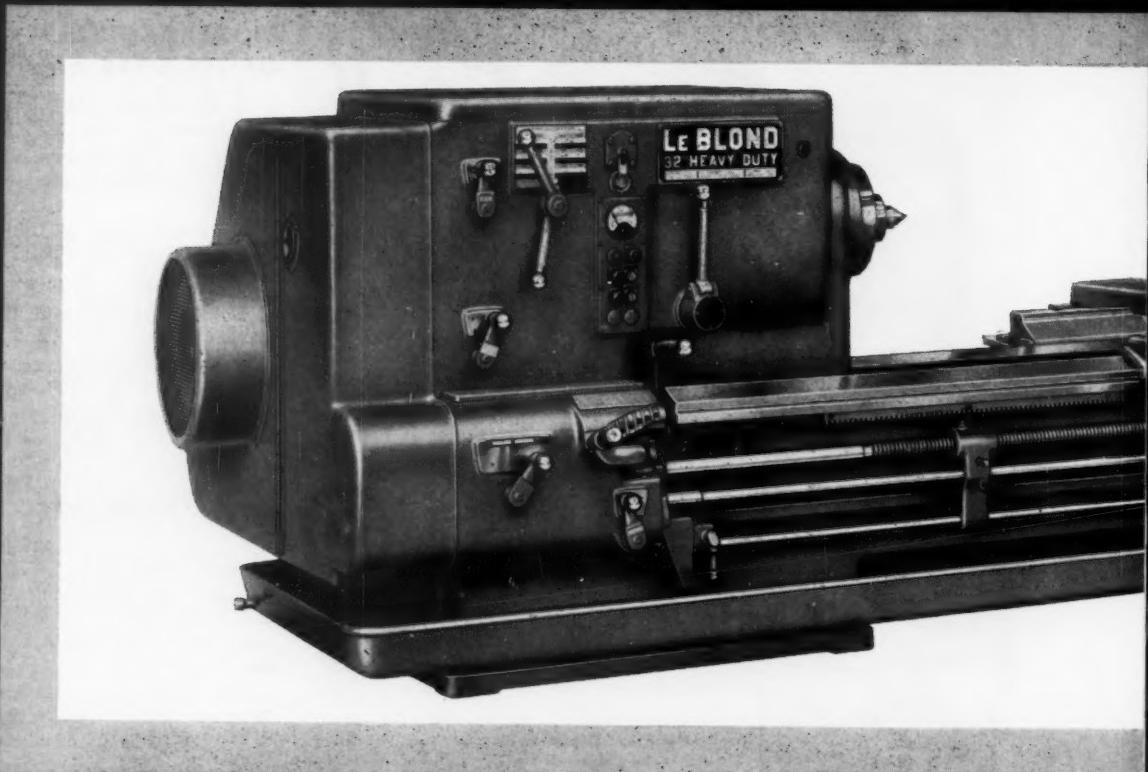
**CLAUSING DIVISION**

**Atlas Press Company**

Quality Machine Tools Since 1911

1-108 N. Pitcher St. • KALAMAZOO, MICH.

**LeBlond 25" Heavy Duty Lathes**  
**LeBlond 32" Heavy Duty Lathes (shown)**



**for today's toughest**

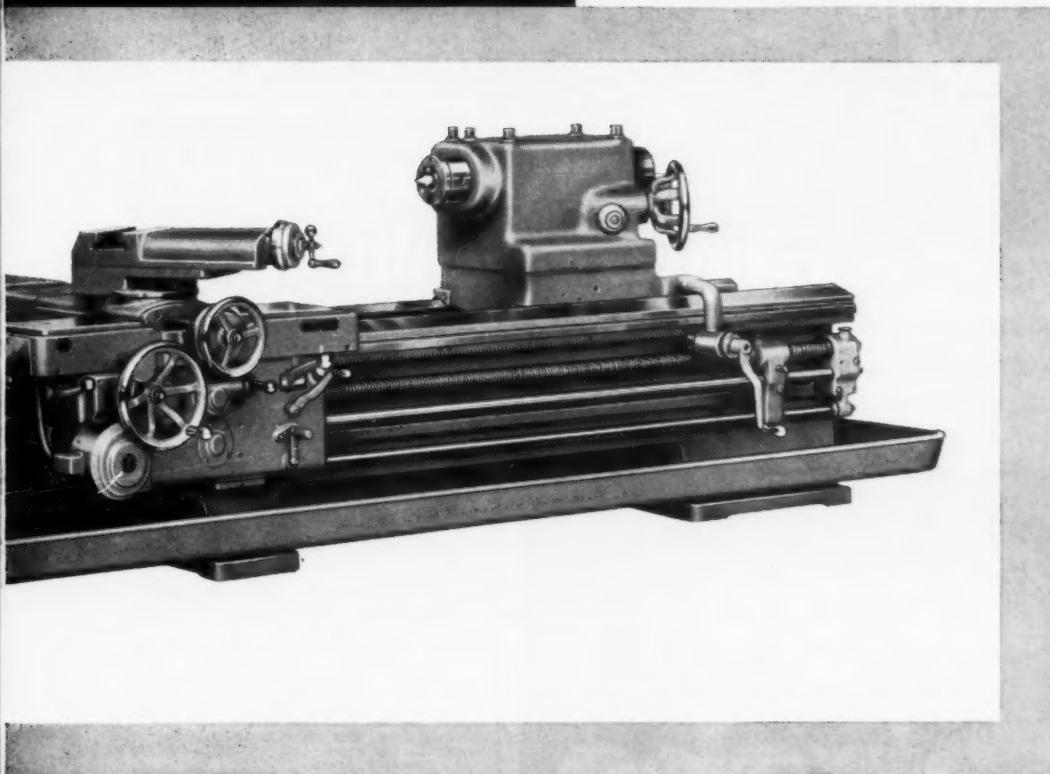
power  
rigidity  
convenience  
safety

50 hp on the 25", 60 hp on the 32". Here's proof of efficiency—maximum no-load friction hp on the 32" is only 3.4 hp @ 500 rpm.

High-capacity 4-bearing spindle. One-piece double-wall apron. Heavy, short shafts; hardened and ground gears. Hardened and ground compensating steel bed ways.

4-directional power rapid traverse, controlled with a single lever. Direct-reading, color-keyed speed change levers. Single-lever feed control.

Adjustable torque to bring heavy work pieces up to speed safely. Similar adjustments for stopping and jogging.



turning

... cut with confidence



THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, O.

World's Largest Builder of A Complete Line of Lathes  
for More than 70 Years



time to  
call a  
specialist

Things going haywire? Simply reach for the phone and call your nearest distributor for the skilled help of a Chicago-Latrobe Service Engineer. His highly specialized experience may save you a lot of time, money and headaches.

# Chicago- Latrobe

Drills and Reamers

**CHICAGO-LATROBE**  
417 W. Ontario St., Chicago 10, Ill.  
OFFICES AND WAREHOUSES  
NEW YORK • DETROIT • CHICAGO • LOS ANGELES



The stocks are large  
and the service is  
great from your  
local Distributor.  
Call him.

Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
Universal Engineering Co., Frankenmuth 2, Mich.  
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.  
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.  
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

#### BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.  
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.  
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Head Machine Co., 10 New Bond St., Worcester 6, Mass.  
Homestrand, Inc., Larchmont, N. Y.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Michigan Drill Head Co., Van Dyke, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Mummert-Dixon Co., Hanover, Pa.  
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.  
Universal Engineering Co., Frankenmuth 2, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

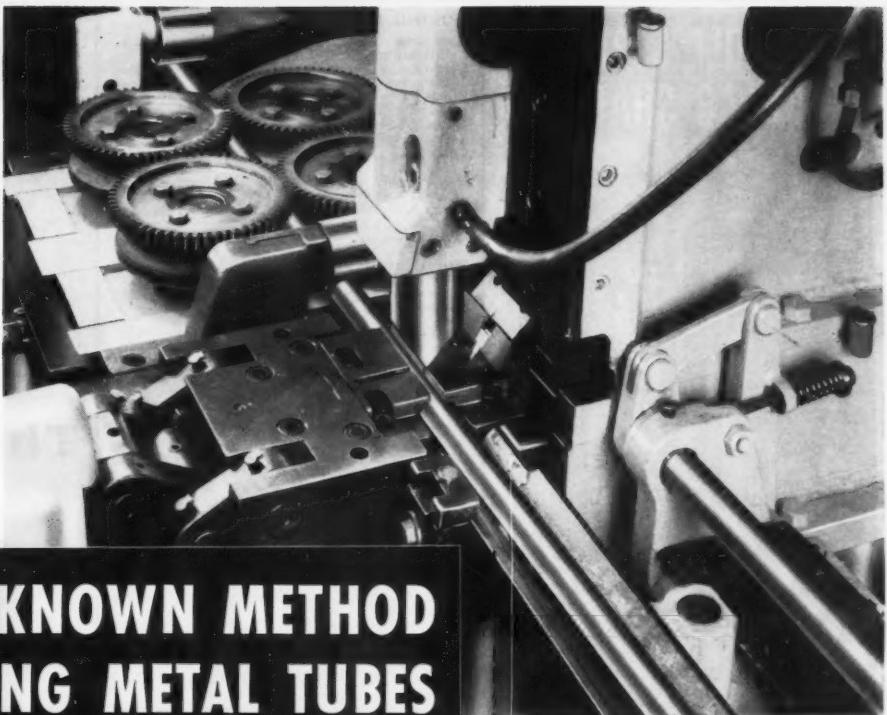
#### BORING MACHINES

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Bullard Co., Bridgeport 6, Conn.  
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.  
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
Homestrand, Inc., Larchmont, N. Y.  
Kearney & Trecker Corp., Milwaukee, Wis.  
LaSalle Tool Inc., 3840 E. Outer Dr., Detroit 34, Mich.  
Michigan Drill Head Co., Van Dyke, Mich.  
Millholland W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Moline Tool Co., Moline, Ill.  
National Automatic Tool Co., Inc., 5 7th and N. Sts., Richmond, Ind.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Olofsson Corp., Lansing, Mich.  
Pope Machinery Co., Haverhill, Mass.  
Sheffield Corp., Box 893, Dayton 1, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.  
Wadell Equipment Co., Clark, N. J.  
Wales-Strippit Co., No. Tonawanda, N. Y.

#### BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Bullard Co., Bridgeport 6, Conn.  
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.  
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17  
Espin-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.  
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.  
New Britain Mch. Co., New Britain, Conn.  
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

(Continued on page 258)



## FASTESt KNOWN METHOD OF CUTTING METAL TUBES

Automatic continuous operation of up to 6,500 cut-offs per hour is approximately 3 to 8 times greater than the speed of competitive methods.

Cutting action in Grieder Tube Cut-off Machines is accomplished by two blades actuated by a crankshaft. A horizontal cut is made first, through the wall thickness of the top of the tube. The vertical blade descends into the opening and completes the cut. The tubing is held firmly in dies which operate as a vise preventing any distortion. Lengths can be held to plus or minus .002" on light wall tubing and to approximately .003" on heavier wall tubing.

Automatic hoppers for feeding tubes and related automation equipment are available in conjunction with Grieder Tube Cut-off Machines for specific applications. Tell us what you want to accomplish.



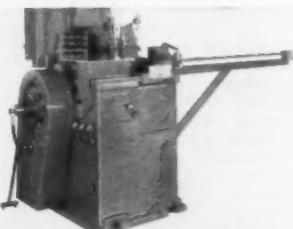
Grieder Tube Cut-off Machines are slicing tubes and slashing costs in most major industries. Write for literature.

**GRIEDER INDUSTRIES, INC.**

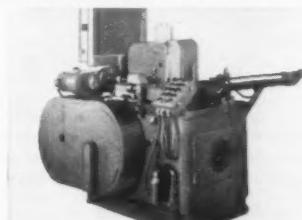
P. O. BOX 169, BOWLING GREEN, OHIO

For more information fill in page number on Inquiry Card, on page 233

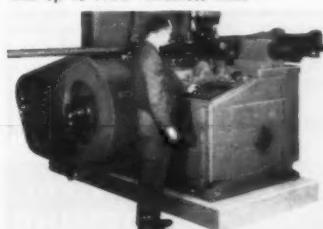
### THREE STANDARD MODELS



NO. 1000-MAC cuts tubes up to  $\frac{3}{4}$ " OD and up to .062" wall thickness.

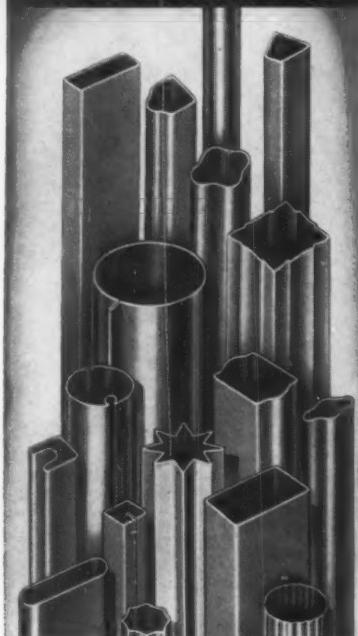


NO. 2000-MAC cuts tubes up to 2" OD and up to .125" thickness wall.



NO. 4000-MAC cuts tubes up to 4" OD and up to .250" wall thickness.

## COLD ROLL FORMING TUBULAR SHAPES



Among the wide variety of things you can make on a Yoder Cold Roll Forming machine are round, square, oval, rectangular and other tubular shapes, such as illustrated. The seams may be open, lapped, butted, dovetailed, interlocking, etc.—as shown in the drawing.

Millions of feet of such unwelded tubular shapes are made from coiled strip for conductor pipe, bedsteads, lamp stands, window channel, wiring raceways, carrying rods, etc. Production ranges from 20,000 to 50,000 feet per day, with only one operator and a helper. Yoder offers you the cooperation of their engineering staff for designing and adapting their cold roll forming machines, auxiliaries, and tooling, for the low cost production of structural, mouldings and trim, panels, tubular and other shapes, to meet individual needs. The Yoder Book on Cold Roll Forming is a complete, illustrated text on the art and the equipment needed for performing a variety of operations which can be combined with cold roll forming, at little or no extra labor cost. A copy is yours for the asking.

**THE YODER COMPANY**  
5504 Welworth Ave. Cleveland 2, Ohio



### BORING MILLS, Vertical

American Schieß Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.  
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
King Machine Tool Div., Cincinnati, Ohio  
New Britain Mch. Co., New Britain, Conn.  
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

### BORING TOOLS

American Schieß Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.  
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.  
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
King Machine Tool Div., Cincinnati, Ohio  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
Star Cutter Co., 34500 Grand River, Farmington, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### BRAKES, Press and Bending

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.  
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.  
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.  
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.  
Ferracute Machine Co., Bridgeton, N. J.  
Lodge & Shipley Co., Hamilton 1, Ohio.  
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

### BRASS

American Brass Co., 25 Broadway, New York, N. Y.  
Bridgeport Brass Co., Bridgeport, Conn.  
Mueller Brass Co., Port Huron 35, Mich.  
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

### BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.  
duMont Corp., Greenfield, Mass.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.  
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.  
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(Continued on page 260)



E. F. HENNIS  
New York

## This Panel



RICHARD O. MORIN  
Philadelphia



R. H. DYSON  
Chicago



C. J. VANDIPTEN  
Voorburg, Holland



J. K. AIKEN  
Springfield, Vt.



L. GRAHAM COLLINS  
New York



F. WARD HIGGINS  
New York

**of Experts Has Never Been Stumped**



BERNARD C. DAY  
Cleveland



T. D. DETHEROW  
Chicago



WALTER AUGUSTEN  
Indianapolis

**Their "Category" is Internal Grinding**



CALEB C. BROWN  
Dayton



L. C. GILCHRIST  
Detroit



E. F. HAWKINS  
Detroit

**Ask Them to Solve Your Problem**

Phone one of these men at the office nearest you

**BRYANT Chucking Grinder Co.**

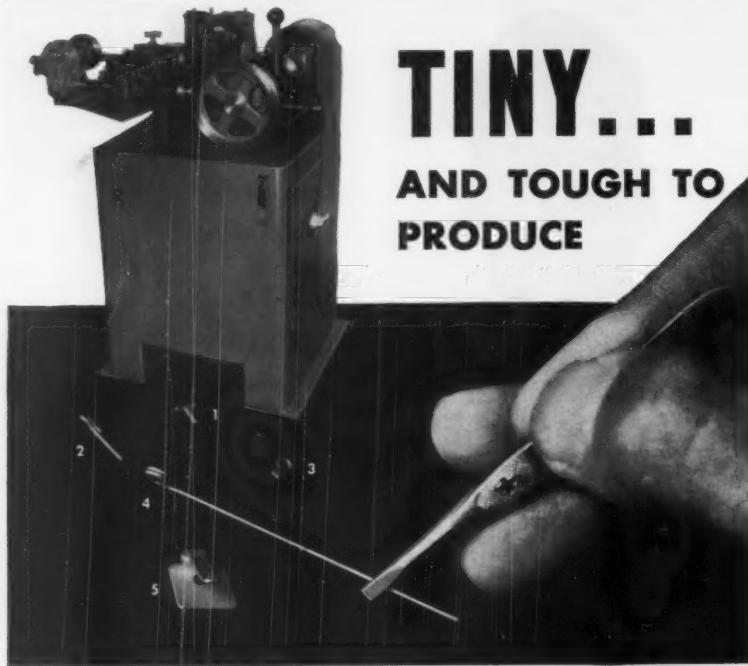
20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—259



## INTRICATE FORMING IS AUTOMATIC ON A NILSON 4-SLIDE

Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easy access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 Mercury Switch Part . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 Electrical Contact . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 Swivel Part . . . .025" brass wire. Heading operating includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 Leadwire . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 Contact Part . . . .010" x 3/8" wide phosphor bronze formed at 175 per minute.

Nilson makes a complete line of versatile 4-Slides . . . accommodating wire diameters up to 1/2", feed lengths up to 32", and ribbon metal up to 3" width . . . with press capacities ranging to 75 tons.

Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogs . . . the first step to increased production.



**A.H. NILSON**  
MACHINE COMPANY

1518 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

### BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Detroit Broach Co., Rochester, Mich.  
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.  
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

### BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.  
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.  
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Detroit Broach Co., Rochester, Mich.  
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.  
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.  
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

### BRONZE

American Brass Co., Waterbury 20, Conn.  
Bridgeport Brass Co., Bridgeport, Conn.  
Mueller Brass Co., Port Huron 35, Mich.

### BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

### BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.  
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

### BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Erie Foundry Co., Erie, Pa.  
Forquhar Div., A. B., 142 N. Duke St., York, Pa.  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

### BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

### BURRING MACHINES—See Deburring Machines

### BURRS—See Files and Burrs, Rotary

### BUSHINGS, Drill Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.  
Universal Engrg. Co., Frankenmuth, Mich.

### BUSHINGS, Hardened Steel

Brown & Sharpe Mfg. Co., Providence, R. I.  
Universal Engrg. Co., Frankenmuth, Mich.

### BUSHINGS, Non-ferrous and Powdered Metal

American Crucible Products Co., Lorain, Ohio.  
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.  
Universal Engrg. Co., Frankenmuth, Mich.

(Continued on page 262)

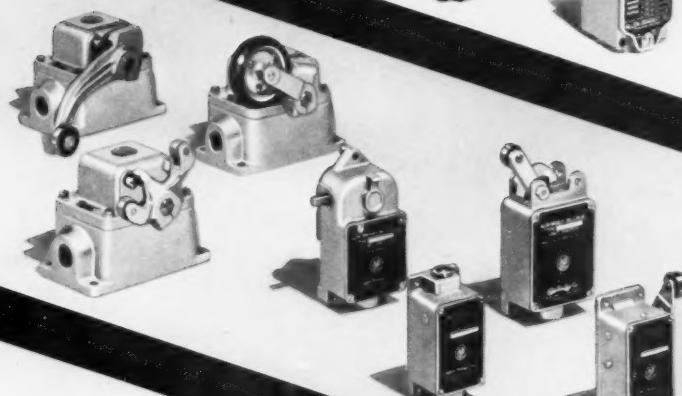
# Need a Limit Switch? WHAT'LL YOU HAVE?

Here are samples of A-B quality limit switches—a line so complete it will satisfy your every requirement!



## OILTIGHT

Bulletin 802T—For high-speed production machines. Sealed to protect the switch against oil and coolants.



## GENERAL PURPOSE

Bulletin 801—Standard or heavy-duty rating, with roller, push type, or fork lever action, and slow or snap action contacts.



## PRECISION

Bulletin 802—For applications where mounting space is small and operating motion is measured in thousandths of an inch.

**ALLEN-BRADLEY**  
QUALITY  
MOTOR CONTROL



Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

# PILOT CONTROLS?

**Yes...Allen-Bradley  
covers the field!**



No matter what your needs for pilot control devices may be . . . refer to the new Allen-Bradley "handy" catalog . . . you will usually find what you are looking for. If not, please write Milwaukee, or contact your nearest Allen-Bradley representative.

All pilot controls are made to Allen-Bradley standards of quality. All of them have silver alloy contacts that require no service attention.

You'll find it saves service time and money to specify Allen-Bradley.

## OILTIGHT PUSH BUTTON STATIONS

### BULLETIN 800T

For machine tool applications, to keep oil away from the contacts. Available in flush, surface, or pendant mounting.



## PHASE FAILURE AND PHASE REVERSAL RELAYS

### BULLETIN 812

Style A disconnects motor if one phase of power circuit fails. Style B protects against phase reversal, as well.



## PRESSURE CONTROLS

### BULLETIN 836

For noncorrosive liquids, vapors, gases, from 30 in. of vacuum to 700 psi. Accurate, rugged, compact, and attractive appearing.



## PLUGGING SWITCHES

### BULLETIN 808P

Used with a simple reversing switch, it provides quick, automatic stopping of machines driven by squirrel cage motors.



## TIMING RELAYS

### BULLETIN 849

A reliable and accurate pneumatic timer with a range of 1/6 to 180 seconds. Many arrangements. Motor driven, electronic and oil dashpot timers also available.



## TEMPERATURE CONTROLS

### BULLETIN 837

For temperatures from -45°F to 440°F. Metal bellows operates snap action precision switch with pure silver contacts.



## FOOT SWITCHES

### BULLETIN 805

For operating punch presses, riveting, welding, and many other machines. Switch has snap acting, normally open and normally closed silver alloy contacts.



## ZERO SPEED SWITCHES

### BULLETIN 808

A plugging switch that brings squirrel cage motors to zero speed quickly, without any reversal of direction.



## FLOAT SWITCHES

### BULLETIN 840

Provide automatic control for motors operating tank or sump pumps.



## ROTARY SWITCHES

### BULLETIN 806

Cam operated switches for the selection or transfer of various control circuits. Silver alloy contacts.



# ALLEN-BRADLEY

## MOTOR CONTROL

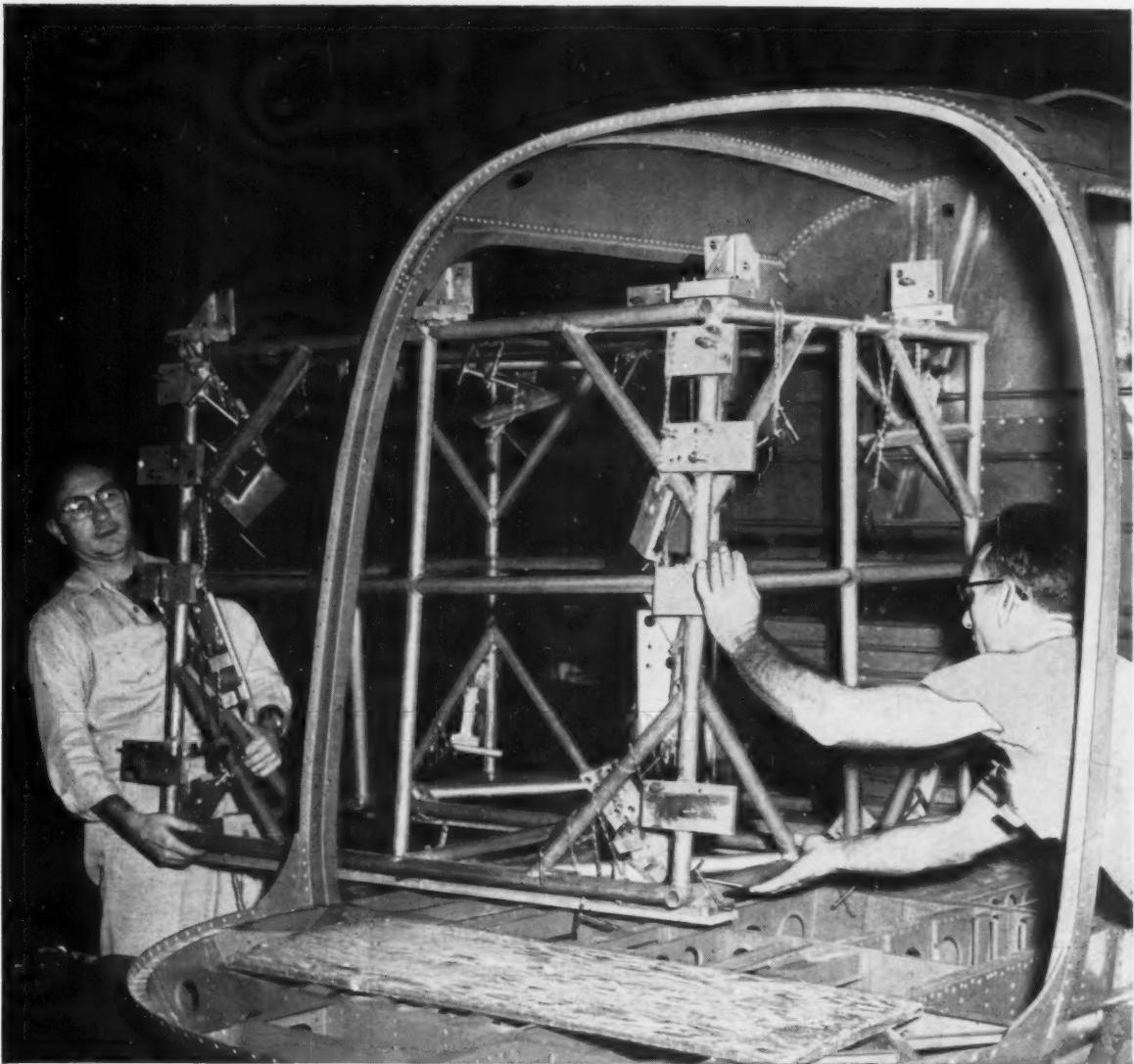


Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

Send for the new 7th  
Edition of the Allen-  
Bradley Handy Catalog.

It is a veritable  
encyclopedia of  
reliable motor control.



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

*Magnesium for accuracy*

## "Lightweight tool helps precision-build Bell 'copters'"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1415V.

**AVAILABLE FROM STOCK AT:** Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill.  
Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif.  
Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON



# AMES

*is preferred*  
when comparison  
is made



MODEL 130 GP.



For fast, accurate measurements, Ames Dial Comparators are the choice of quality control men everywhere. You get definite, impersonal readings directly from the dial. There's no guesswork or figuring.

Special comparators are available for measuring resilient materials such as rubber, paper, etc., and for measuring non-yielding materials such as sheet metal, glass and plastic. Write for complete details.



Representatives in principal cities



B.C. AMES CO.

27 Ames Street, Waltham 54, Mass.

MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

## CABINETS, Tool

Brown & Sharpe Mfg. Co., Providence, R. I.  
Standard Pressed Steel Co., Jenkintown, Pa.

**CALIPERS, Spring, Firm-Joint, Transfer, Termaphrodite, etc.**—See Layout and Drafting Tools; Machinists' Small Tools

## CALIPERS, Vernier

Brown & Sharpe Mfg. Co., Providence, R. I.  
DoAll Co., Des Plaines, Ill.  
Scherr, George, Co., Inc., 200 Lafayette St.,  
New York 12 N. Y.  
Starrett, The L. S. Co., Athol, Mass.

## CAM CUTTING MACHINES

Cincinnati Milling and Grinding Mch., Inc.,  
Cincinnati 9, Ohio.  
Pratt & Whitney Co., Inc., West Hartford,  
Conn.  
Russell Holbrook & Henderson, Inc., 292  
Madison Ave., New York 17, N. Y.  
Sundstrand Mch. Tool Co., 2531—11th St.,  
Rockford, Ill.  
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

## CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave.,  
Pittsburgh 22, Pa.  
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.  
Landis Tool Co., Waynesboro, Pa.  
Rowbottom Machine Co., Waterbury, Conn.

## CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.  
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.  
Rowbottom Machine Co., Waterbury, Conn.

## CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Besley-Wells Corp., 112 Dearborn Ave., South Beloit, Ill.  
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.  
DoAll Co., Des Plaines, Ill.  
Kennametal, Inc., Latrobe, Pa.  
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.  
Metal Carbides Corp., Youngstown, Ohio.  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

## CASTINGS, Die

American Brass Co., Waterbury 20, Conn.  
Madison-Kipp Corp., Madison, Wis.

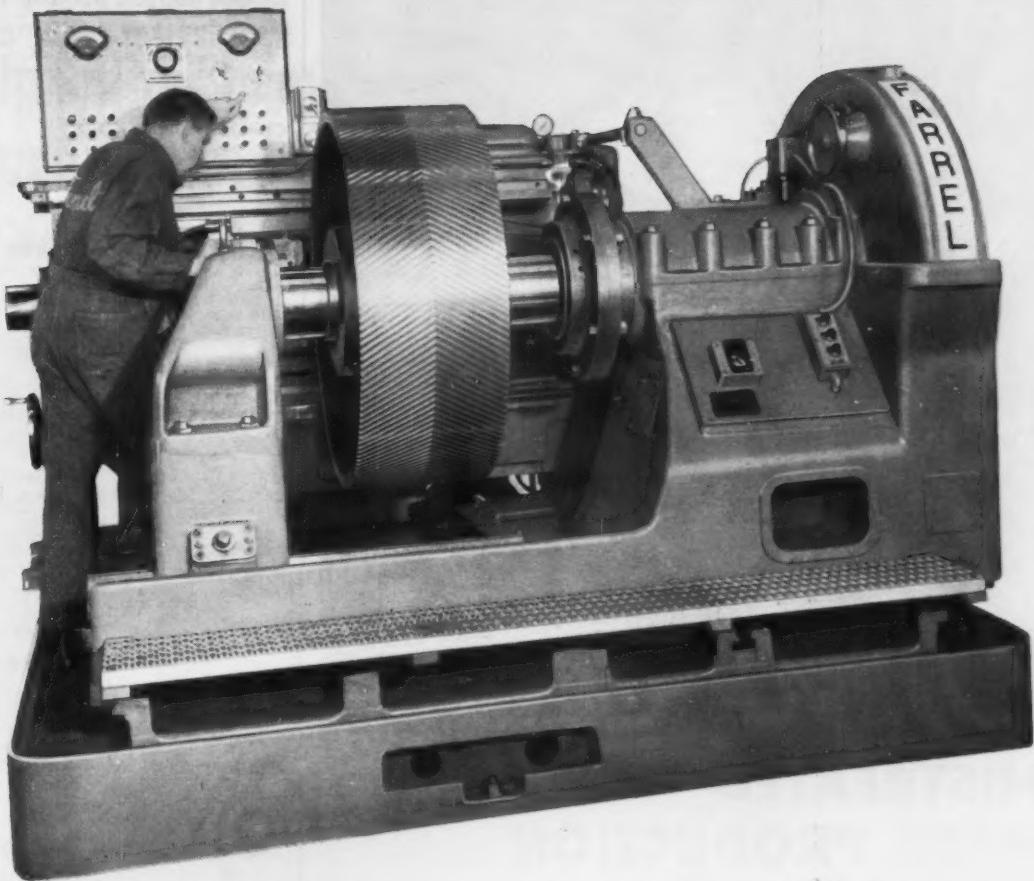
## CASTINGS, Non-ferrous

American Crucible Products Co., Lorain, Ohio.  
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.  
Centrifugally Cast Products Div.—Shenango Furnace Co., Denver, Ohio.  
Dow Chemical Co., Midland, Mich.  
Mueller Brass Co., Port Huron 35, Mich.  
Vascoloy-Ramet Corp., North Chicago, Ill.

## CASTINGS, Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.  
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio.  
Challenge Mchry. Co., Grand Haven, Mich.  
Farrel-Birmingham Co., Inc., Ansonia, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(Continued on page 264)



## He's saving time and money in cutting a precision gear

The man in the photo is turning out a high-precision herringbone gear on a Farrel-Sykes "Twin-Head" gear generator. Ease of operation plus high cutting speeds reduce man and machine hours to a minimum. The result is an important decrease in manufacturing cost.

The operator's job is simplified by the machine's complete electrohydro control. For all functions, the machine responds instantly to the controls centrally located on a single panel at the operator's station. Fullest advantage of the extreme accuracy and high production speed of the machine is obtained.

Farrel-Sykes "Twin-Head" gear generators make fast, simple work of cutting every type of herringbone gear,

single helical and spur gears with external or internal teeth, and, with special tooling, other toothed forms and contours. High precision gears are generated as readily as ordinary commercial gears; commercial gears are generated more accurately without adding to their cost.

If you would like complete details, we shall be glad to send them. No obligation, of course.

**FARREL-BIRMINGHAM COMPANY, INC.**  
**ANSONIA, CONNECTICUT**

*Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.*

*Sales Offices: Ansonia, Buffalo, Akron, Chicago, Los Angeles, Houston*

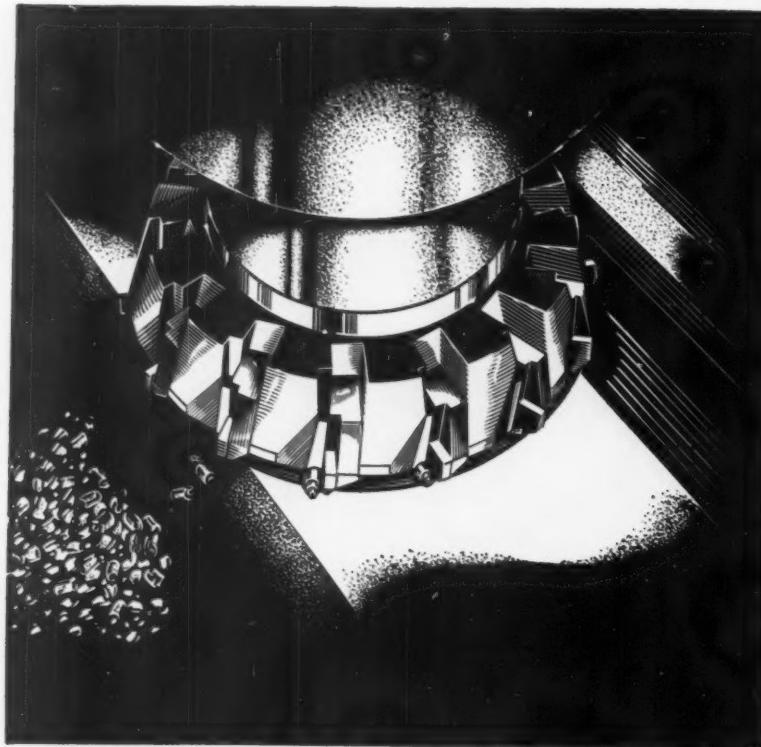
*European Office: Piazza della Repubblica 32, Milano, Italy*

***Farrel-Birmingham®***

FB-1108

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—263



## "MISTREATED MASS PRODUCTION MANIAC"

**T**hat's the inserted blade carbide tipped milling cutter. Here's a tool that really outperforms ordinary milling cutters when it's used right. It makes possible increased production with more pieces per grind and better finishes at lower cost.

Economical milling with carbides requires careful tool engineering. This has been recognized for many years at Go & Go. Failure to do so has soured many a carbide application.

Go & Go produces a complete line of inserted blade carbide milling cutters including tools designed for specific jobs (specials). We think they're the finest you can buy because sound engineering comes with these cutters. If your application isn't right for them, we'll tell you so. And we'll tell you how to make it right.

For specifications on a really complete line of inserted blade carbide milling cutters, ask for Catalog "F". Or better still, consult the Go & Go engineering sales representative in your area.

**Go & Go**

### GODDARD & GODDARD COMPANY

DETROIT 23, MICHIGAN

Engineering and producing tools that Go & Go since 1917.

**CASTINGS, Steel, Stainless, etc.**  
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., 701 East Third St.,  
Bethlehem, Pa.  
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.  
Crucible Steel Co. of America, Henry W.  
Oliver Bldg., Pittsburgh 22, Pa.  
Farrel-Birmingham Co., Inc., Ansonia, Conn.

### CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave.,  
Pittsburgh 8, Pa.  
Walls Sales Corp., 333 Nassau Ave., Brooklyn  
22, N. Y.

### CENTER-DRILLING MACHINES

Baker Brothers, Inc., 1000 Post St., Toledo 10,  
Ohio  
La Salle Tool Inc., 3840 E. Outer Dr., Detroit  
34, Mich.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Sundstrand Mch. Tool Co., 2531 11th St.,  
Rockford, Ill.

**CENTER PUNCHES** — See Machinists' Small Tools

### CENTERS, Grinding Machines, Indexing Head and Lathe

Brown & Sharpe Mfg. Co., Providence, R. I.  
Buck Tool Co., 220 Schippers Lane, Kalama-zoo, Mich.  
Metal Carbides Corp., Youngstown, Ohio  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.  
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**CERAMIC TOOL MATERIAL** — See Tool Material, Ceramic

### CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

### CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Coulter, James Mch. Co., 629 Railroad Ave., Bridgeport 5, Conn.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Jones & Lamson Mch. Co., Springfield, Vt.  
National Acme Co., 170 E. 131st St., Cleve-land, Ohio  
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.  
Reid Bros. Co., Inc., Beverly, Mass.  
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

### CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.  
Cone Automatic Mch. Co., Inc., Windsor, Vt.  
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Goss & DeLeeuw Mch. Co., Kensington, Conn.  
National Acme Co., 170 E. 131st St., Cleve-land, Ohio  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Olafsson Corp., 2729 Lyons Ave., Lansing, Mich.

(Continued on page 266)

# Betts 48" lathe designed for heavy roughing as well as extra fine finishing *(for years to come)*

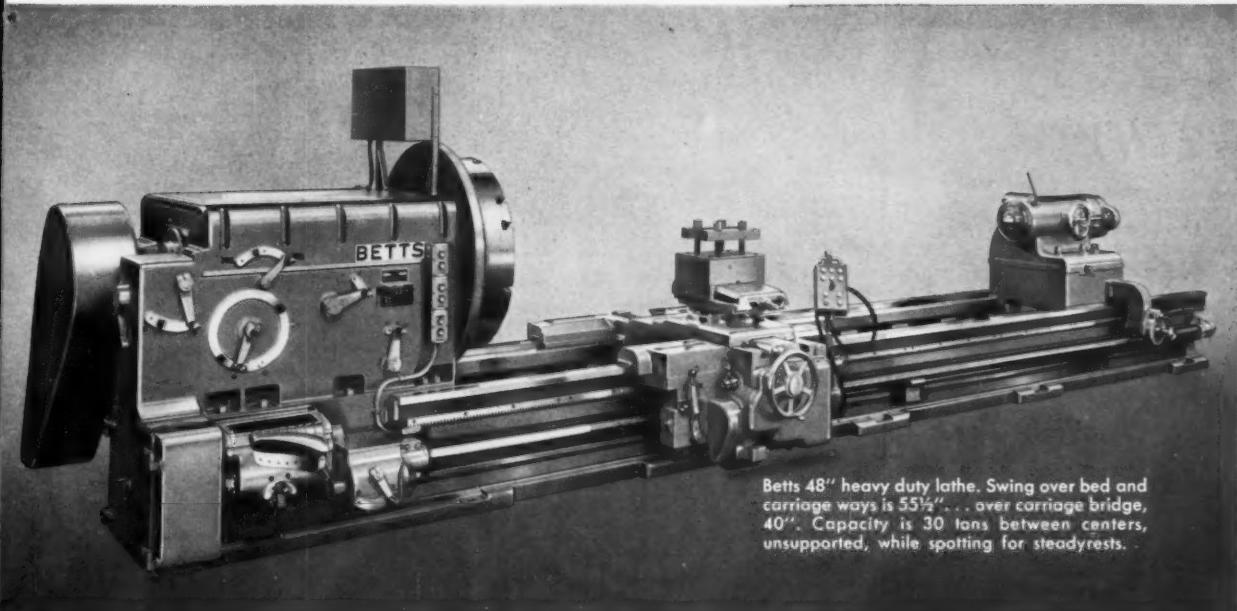
THESE FEATURES TELL YOU WHY  
BETTS IS THE BETTER BUY:

**MECHANICAL FEEDS** . . . 56 feed and thread changes — all by lever shift, without transposing gears.

**OPTIONAL ELECTRONIC FEED** . . . rate adjustable by potentiometer in fine increments without stopping.

**ANTIFRICTION HEADSTOCK SPINDLE BEARINGS** . . . are cartridge mounted. This affords equal pre-load pressure around the full circumference of the bearings, resulting in closer working tolerances.

**DRIVE GEARS OF ALLOY STEEL** . . . are single or double helical with hardened teeth. Double helical gears have continuous teeth for extra strength and stamina.



Betts 48" heavy duty lathe. Swing over bed and carriage ways is 55½" . . . over carriage bridge, 40". Capacity is 30 tons between centers, unsupported, while spotting for steadyrests.

With this Betts lathe, you can remove a lot of metal fast, or turn out closest tolerance finishing. And the portable push-button panel gives you finger-tip control of all important functions.

Standing on the floor or on either side of the carriage, the operator can control the main-drive motor, carriage-traverse motor, and selection of feed or traverse and cross or longitudinal movement of the tool. Such operator convenience is particularly valuable in a lathe of this size.

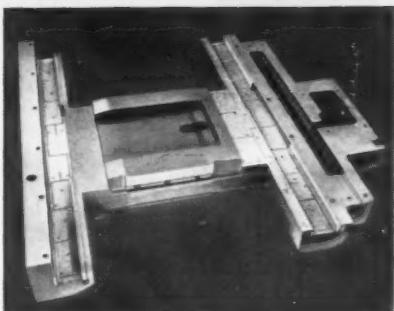
Of equal importance, is the durability built into the machine for maintaining accuracy over the years; for example, the bronze liners and shoes on which the carriage moves along the ways. It is details like this that make a Betts lathe so outstanding.

Before you decide on a lathe, discuss your requirements with Consolidated. The company has made some of industry's biggest and best machine tools.

**CONSOLIDATED MACHINE TOOL DIVISION**  
**FARREL-BIRMINGHAM COMPANY, INC.**

Rochester 10, New York

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.



**BEDS 45" WIDE OVER WAYS** . . . and 48" wide over feet, providing stability for heavy cuts. Carriage mating surfaces are lined with replaceable bronze liners and bronze taper shoes, assuring long wear and accuracy over the years. (See illustration)

**BUILT-IN ANTIFRICTION TAILSTOCK SPINDLE** . . . mounted front and rear in double antifriction bearings, can produce accuracies within .0005" runout. 11" diameter quill is springloaded to compensate for work expansion.

**BOLTED-ON FLANGE-TYPE CENTERS** . . . for headstock and tailstock spindles. This rigid mounting helps retain accuracy in handling heavier loads at high speed.

# INVESTIGATE!



It's just good business to specify Promet Engineered Bronze Bearings, Bushings and Wearings. Parts. For proof send prints and condition of operation for recommendations and quotations.

# SPECIFY!

Superior service guaranteed or your money back! Special formulas, developed for specific or unusual conditions. Will not cut or stick to the shaft under ordinary operating conditions. Carry on during temporary lubrication failures. Absolutely will not powder in severest service.



# SAVE!

Highest quality machining to precisely controlled tolerances.



Difficult oil grooving... smooth grooves, even around acute bends... no sharp edges or burrs... remarkably better lubrication.

Also available rough cast.

## SEND PRINTS

and  
condition of operation  
for recommendations,  
quotations, literature  
and service data  
sheets.



## The American Crucible PRODUCTS CO.

*"Bearing Specialists Since 1919"*

1395 OBERLIN AVENUE, LORAIN, OHIO, U.S.A.  
Please send free literature and service data  
sheets on Promet Bronze.

NAME \_\_\_\_\_  
COMPANY \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY & STATE \_\_\_\_\_

Pratt & Whitney Co., Inc., West Hartford, Conn.  
Warren & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

### CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.  
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.  
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

### CHUCKS, Collet

Brown & Sharpe Mfg. Co., Providence, R. I.  
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
Erington Mech. Lab., Inc., 24 Norwood Ave., Staten Island 4, N. Y.  
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.  
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.  
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.  
Jacobs Mfg. Co., West Hartford 10, Conn.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Universal Engrg. Co., Frankenmuth 2, Mich.  
Warren & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

### CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.  
Gisholt Mch. Co., Madison 10, Wis.  
Horton Chuck, Windsor Locks, Conn.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

### CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.  
Logansport Mch. Co., Inc., Logansport, Ind.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

### CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
Wadell Equip. Co., Terminal Ave., Clark, N. J.

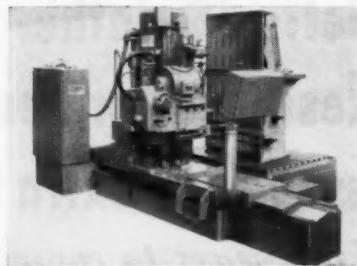
### CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.  
Jacobs Mfg. Co., West Hartford, Conn.  
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

### CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.  
Jacobs Mfg. Co., West Hartford, Conn.  
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

(Continued on page 268)



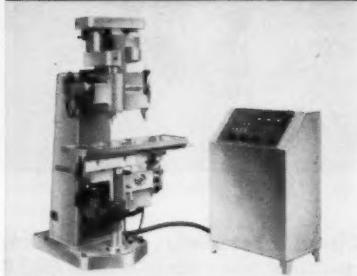
### A P&W Tracer-Controlled MILLER FOR EVERY JOB

#### KELLER Type BG-21

... A powerful, versatile machine made in a range of sizes from 5' x 2 1/2' to 10' x 4' in single spindle or 2-spindle models.

#### KELLER Type BL

... A compact powerful Tracer-Controlled Miller for work within the range of 36" x 20", with all the new KELLER features. Single spindle and 3-spindle models.

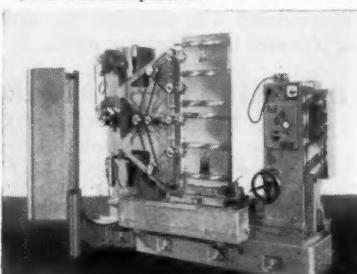


### VELVETRACE® Kelling Machine

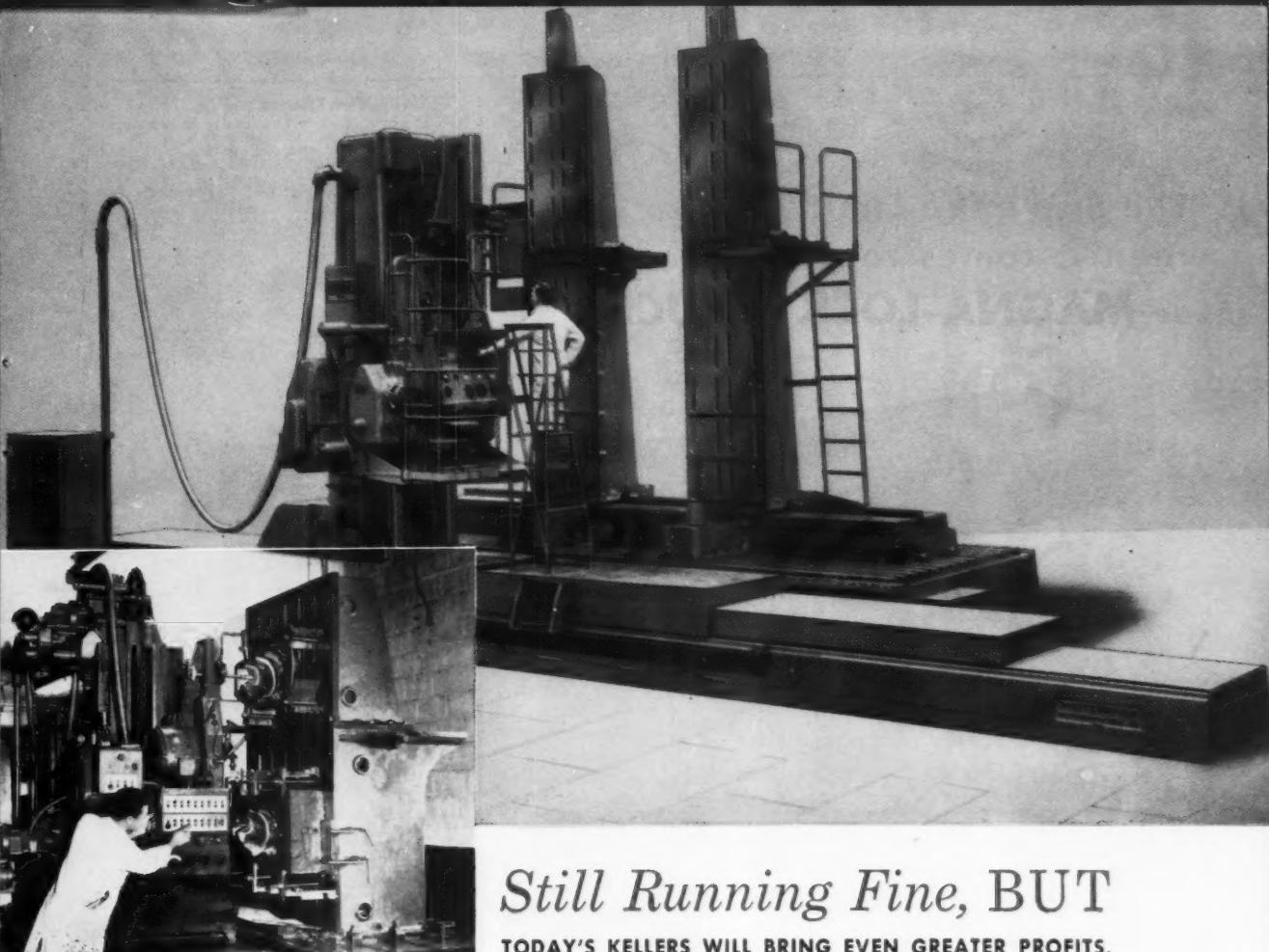
... Duplicates the finest detail with extreme precision. New, non-contacting tracer accurately follows any 3-dimensional model without touching it. Cannot damage the softest, most fragile models.

#### Automatic Duplicating Machine

... Specially designed for low cost production of forging dies and molds for glass and plastic. Automatically re-produces original dies and molds with precision and remarkable detail. There are two versions of this machine, one for machining bottle molds, one for forging dies. Supplied with 1, 2 or 4 cutter spindles.



For more information fill in page number on Inquiry Card, on page 233



## *Still Running Fine, BUT*

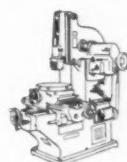
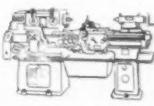
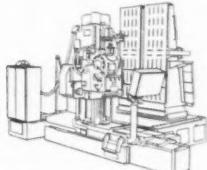
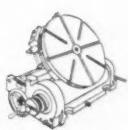
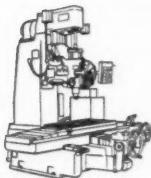
**TODAY'S KELLERS WILL BRING EVEN GREATER PROFITS.**

You may put off replacing an older machine because "it's still paying its way." But is it? A machine tool purchased years ago may be the cause of lost efficiency, higher labor and per-unit costs, the inability to produce high quality *economically*. Failure to compete profitably with more modern machines may be putting you far behind your competitors. For example, just 10 short years ago our Keller BG-2 Tracer-Controlled Miller was the ultimate in productive efficiency, but let's check the added features possessed by its successor, the new P&W BG-22 Keller . . .

1. Operates from any conventional polyphase current, with no motor generator set required.
2. Increased travel speed of cutting tool . . . to an infinitely variable range from 0.5 to 30.0 inches per minute.
3. Three dimensional tracer permits motion in 2 directions at the same time, yet allows interlocking action for accuracy. One slide is kept always in motion, while the second moves as required to follow the shape and maintain accurate interlocking action.
4. More nearly perfect surface cutting speed over irregular contours assured through superimposed auto-speed control of all motions.
5. Increased capacities . . . up to 20 feet horizontal x 7 feet vertical.
6. Centralized operator controls supplemented by remote control stations.
7. Rapid traverse in all three motions.
8. Automatic lubrication.
9. Score-proof phenolic bearing surfaces on all slides and lead screw nuts.

*Write for complete information.*

*Pratt & Whitney Company, Incorporated  
12 Charter Oak Boulevard, West Hartford, Conn.*



**JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS**



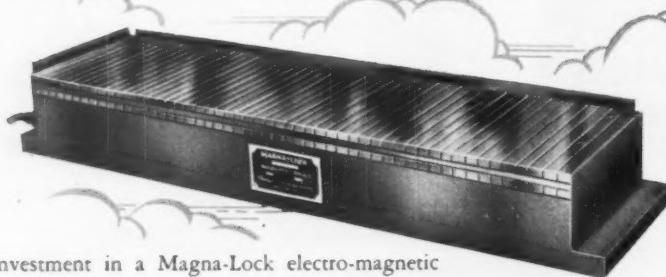
# **PRATT & WHITNEY**

**FIRST CHOICE FOR ACCURACY  
MACHINE TOOLS • GAGES • CUTTING TOOLS**

*Pratt & Whitney Company, Incorporated  
10 Charter Oak Boulevard, West Hartford, Conn.*

*Pratt & Whitney Company, Incorporated  
13 Charter Oak Boulevard, West Hartford, Conn.*

**"The Sky's The Limit"  
when it comes to profitable uses  
for MAGNA-LOCK CHUCKS**



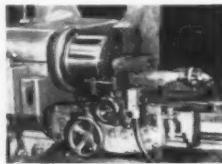
Your investment in a Magna-Lock electro-magnetic chuck is an investment in *versatility* which pays real dividends many times over. In addition to normal surface grinding operations, users are constantly finding new and practical applications of the *extra holding power* of Magna-Lock Chucks for jobs such as these:



**MILLING OPERATION**



**FLAME HARDENING**



**LATHE OPERATION**



**LAYOUT WORK**



**TRANSFERRING PARTS**

loading and unloading water heater shells at Permaglas Div., A. O. Smith Corp.



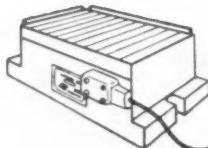
**HAND FILING**

Your jobs, too, can be done faster, at less cost through the 22% *extra holding power* of Magna-Lock Chucks—all steel, moisture-proof, shock-proof. Rectangular chucks from 5" x 10" to 30" x 96" working surfaces—rotary chucks from 6 1/4" diameter face to 72" diameter—swiveling chucks from 5" x 10" to 12" x 84".

To get the most for your money, specify Magna-Lock. To make the most of Magna-Lock versatility, consult our engineers about your idea or problem. We'll be happy to work with you.

WRITE DEPT. M-17

Request Magna-Lock as *original equipment* on your new machines.



**Hanchett MAGNA-LOCK  
CORPORATION**  
**BIG RAPIDS, MICHIGAN, U. S. A.**

designers and makers of a complete line of magnetic chucks and devices.

**CHUCKS, Full Floating**

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.  
Gisholt Mch. Co., Madison 10, Wis.  
Homer & Co., 1903 Rockwell St., Chicago 8, Ill.  
Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Gear**

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.  
Horton Chuck, Windsor Locks, Conn.  
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago, Ill.

**CHUCKS, Independent**

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.  
Gisholt Mch. Co., Madison 10, Wis.  
Homestead, Inc., Larchmont, N. Y.  
Horton Chuck, Windsor Locks, Conn.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Lathes, etc.**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.  
Bullard Co., Brewster St., Bridgeport 2, Conn.  
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois (Milling Machine)  
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.  
Gisholt Mch. Co., Madison 10, Wis.  
Horton Chuck, Windsor Locks, Conn.  
Jacobs Mfg. Co., West Hartford, Conn.  
Jones & Lamson Mch. Co., Springfield, Vt.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.  
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**CHUCKS, Magnetic**

Brown & Sharpe Mfg. Co., Providence, R. I.  
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Hanchett Magna-Lock Corp., Big Rapids, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Walker, O. S., Co., Inc., Worcester, Mass.

**CHUCKS, Power Operated**

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.  
Gisholt Mch. Co., Madison 10, Wis.  
Logansport Mch. Co., Inc., Logansport, Ind.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Quick Change and Safety**

Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.  
Jacobs Mfg. Co., West Hartford 10, Conn.  
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Ring Wheel**

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

**CHUCKS, Tapping**

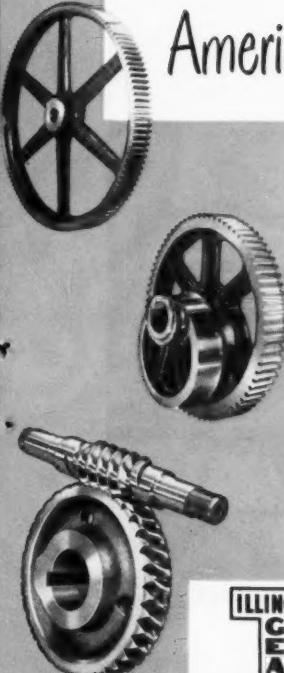
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.  
Jacobs Mfg. Co., West Hartford, Conn.

(Continued on page 270)



# ILLINOIS GEARS

America's most complete line of Gears-



From the modern plants of Illinois Gear come the  
most complete line of gears in America.

Whatever the requirement . . . spur, bevel, helical, herringbone,  
worm and worm gears, spiral bevel gears, etc. . . .  
look to Illinois Gear to fill your needs.

Consider too, the wide ranges of sizes available . . .  
from gears weighing as little as one ounce to  
those weighing 100,000 pounds per gear.

Regardless of the service, whether it's gears for rotating massive  
shovels, or gears that control delicate precision equipment,  
choose from America's most complete line of gears.

Look for this mark  the symbol on finer gears



*Gears for Every Purpose . . . one gear or 10,000 or more*

**ILLINOIS GEAR & MACHINE COMPANY**

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS





"FAIRFIELD

for FINE GEARS"

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

#### CHUCKS, Universal Three-Jaw

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.  
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.  
Gisholt Mch. Co., Madison 10, Wis.  
Homestrand, Inc., Larchmont, N. Y.  
Horton Chuck, Windsor Locks, Conn.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
Logansport Mch. Co., Inc., Logansport, Ind.  
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.  
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

#### CHUCKS, Wrenchless

Gisholt Mch. Co., Madison 10, Wis.

#### CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

**CLAMPS, "C", Toggle, Toolmakers' Parallel**—See Set-Up Equipment  
**Splicing Equipment**

#### CLEANERS, Metal

Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.  
Oakite Products, Inc., 19 Rector St., New York, N. Y.

#### CLUTCHES

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
Minster Mch. Co., Minster, Ohio  
Rockford Clutch Div., Rockford, Ill.  
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

**COLLETS**—See Chucks, Collet

**COMBINATION SQUARES**—See Machinists' Small Tools

#### COMPARATORS, Dial, Electronic and Air

DoAll Co., Des Plaines, Ill.  
Standard Gage Co., Inc., Poughkeepsie, N. Y.  
Starrett, L. S., Co., Athol, Mass.

#### COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
Eastman Kodak Co., Rochester, N. Y.  
Jones & Lamson Mch. Co., Springfield, Vt.  
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

**COMPOUNDS, Cleaning**—See Cleaners, Metal

**COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.**—See Cutting and Grinding Fluids

#### COMPRESSORS, Air

Chicago Pneumatic Tool Co., New York 17, N. Y.  
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
Wilson, K. R., Inc., Arcade, N. Y.

(Continued on page 273)

**FAIRFIELD**  
MANUFACTURING CO.



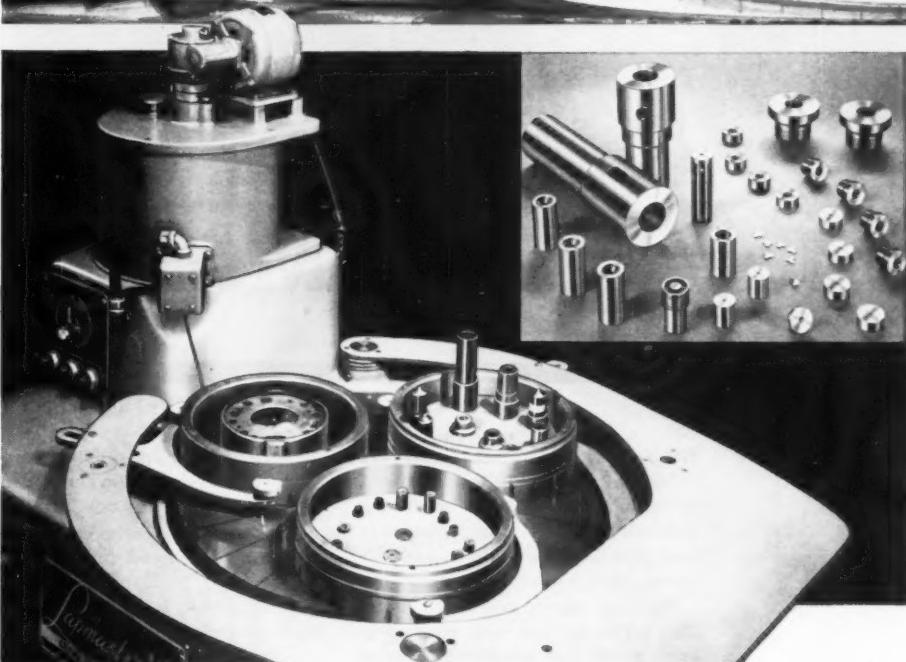
2331  
S. Concord Rd.



Lafayette,  
Indiana

# Diesel Fuel Injector Parts Get Precision Flatness, Finish and Parallelity on

*Lapmasters®*



**John Crane**



MECHANICAL PACKINGS



SHAFT SEALS



TEFLON PRODUCTS



LAPPING MACHINES



THREAD COMPOUNDS

**CRANE PACKING COMPANY**

6433 Oakton Street, Morton Grove, Illinois (Chicago Suburb) In Canada: 617 Parkdale Ave., Hamilton, Ontario

For more information fill in page number on Inquiry Card, on page 233

## ... here's why and how

"John Crane" Lapmasters are taking over the highly critical and essential job of making diesel fuel injectors absolutely leak-proof—and doing it at a considerable reduction in cost over previous methods.

Both engine shops and injector manufacturers have found the Lapmaster a highly successful machine tool for obtaining the required flatness and finish on the mating surfaces of valve nozzle bodies, holders and spacers . . . have found they can run any combination of parts best suited to their production requirements . . . have reduced inspection and rework to the vanishing point.

Lapmasters consistently produce flatness to less than one light band (11.6 millionth of an inch) surface finishes of 2 to 3 RMS on practically every kind of material including all ferrous metals, magnesium, aluminum, brass, carbon, ceramics and plastics.

There is a correct size Lapmaster for your requirement. Investigate the possibilities of this modern machine for your work.



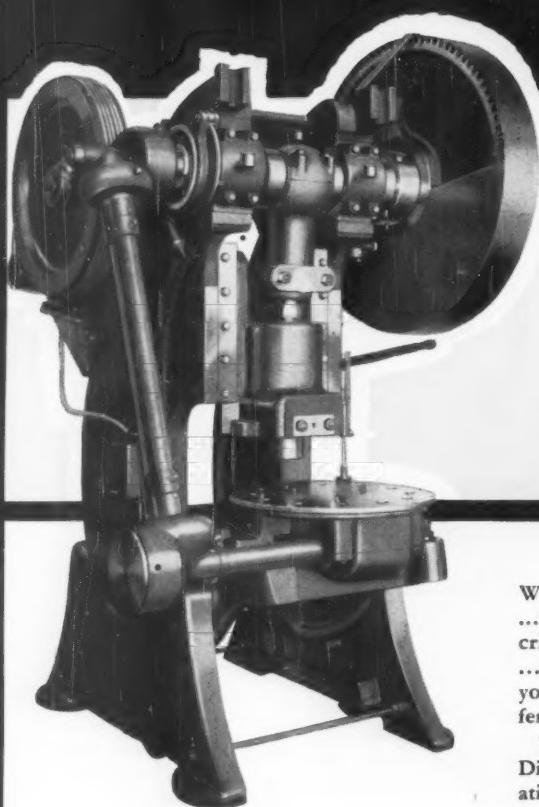
### FREE DATA

Send for these three booklets which describe in detail how to produce and measure precision flatness and finish.



ARROWS SHOW MATING SURFACES LAPPED

MODERN  
FEDERAL  
DIAL  
FEEDS  
have what  
it takes!



No. 7 Dial Feed  
Capacity, 80 tons

What's the job? Drawing...staking...forming...piercing...stamping...crimping...punching...broaching...burring...assembling? Maybe in your plant it's all of them, or a different, unique operation.

We'll lay two-to-one that Federal Dial Feeds are just what your operation needs. For the possibilities of this press with special jigging are

practically unlimited. Add automatic feed and ejection and you have the answer to many cost problems.

Modernize now with Federals and eliminate the need for expensive, specialized equipment. Rugged, precision-built Federals embody the finest materials and workmanship. Available in sizes from 6 to 80 tons. Write for new *Dial Feed Catalog*.

THE FEDERAL PRESS COMPANY  
701 Division Street, Elkhart, Indiana

**FEDERAL DIAL FEED PRESSES**

31 Years' Experience in Dial Feed Engineering and Construction



**It's Not The  
TOOT  
That Runs  
The Train**

Frank Sorenson, Jr.

TREASURER, THE CINCINNATI GEAR CO.

Did you ever get a tune lodged in the back of your head, and not be able to get it out? I happened to hear a catchy children's record awhile ago that keeps popping up in my mind; I'm a little fuzzy on the exact details but the gist of the lyrics is that "it's not the toot that runs the train, but the chug chug chug." Even though the song was obviously written to appeal to young children, the simple logic of its message is just as important to us grown-ups. Because it is all too easy to lose track of basic objectives in the normal rush of competitive business and the manufacture of a competitive product. To cut a nickel here or there off the "toot" to meet competition is one thing; but if a dime or two also gets cut off the "chug chug chug" for the same reason, it may show up for the first time when the product is in the consumer's hands—with lasting adverse effects. Any such quality lapse in the important O.E. products into which many of our custom gears go would be a serious matter for the manufacturer. Our clients know this, and they know that a gear can be a crucial part in their product—and that's why they come to us. They have found from experience that we make their custom gear costs inexpensive by giving them the quality and service they require. We'll do the same for your firm, if given the opportunity.

### THE CINCINNATI GEAR CO. CINCINNATI 27, OHIO

Fifty Years of "Gears—Good Gears Only"



For more information fill in page number on Inquiry Card, on page 233

### CONTOUR FOLLOWER—See Tracing Attachments

### CONTRACT WORK

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Bliss, E. C., Co., 1375 Raff Rd. S. D., Canton, Ohio  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Eisler Engng. Co., 750 S. 13th St., Newark 3, N. J.  
Eric Foundry Co., Erie, Pa.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
Lake Erie Engng. Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Michigan Drill Head Co., Van Dyke, Mich.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio  
Van Keuren Co., Watertown, Mass.

### CONTROLLERS

Allison-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Doeleam Div., Minneapolis-Honeywell, 1400 Soldier Field Rd., Boston 25, Mass.  
General Electric Co., Schenectady, N. Y.

### CONVEYORS FOR DUST, CHIPS, ETC.

Barnes, W. F. & John Co., Rockford, Ill.  
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.

### COPPER

American Brass Co., 25 Broadway, New York, N. Y.  
Mueller Brass Co., Port Huron 35, Mich.  
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

### COUNTERBORES AND COUNTERSINKS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio  
DoAll Co., Des Plaines, Ill.  
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.  
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York  
Heller Tool Co., Newcomerstown, Ohio  
National Twist Drill & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
Star Cutter Co., 34500 Grand River, Farmington, Mich.  
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.  
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

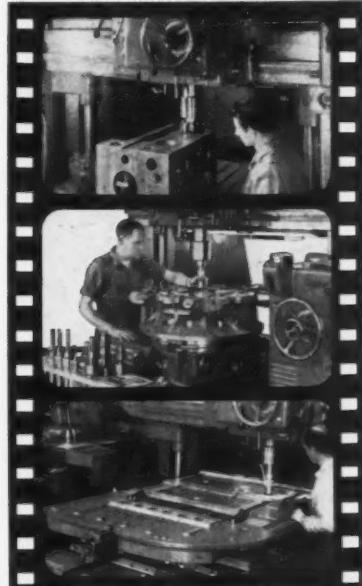
### COUNTERS

Brown & Sharpe Mfg. Co., Providence, R. I.  
Starrett, The L. S. Co., Athol, Mass.

### COUPLINGS

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.  
Farrel-Birmingham Co., Inc., Ansonia, Conn.  
Mueller Brass Co., Port Huron, Mich.  
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.  
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.  
Standard Pressed Steel Co., Jenkintown, Pa. (Shofft)  
Thor Power Tool Co., 175 N. State St., Aurora, Ill.  
Twin Disc Clutch Co., Racine, Wis.  
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

(Continued on page 273)



### GUARANTEED ACCURACY

—as attained with any of the 7 SIP JIG BORERS and SIP OPTICAL JIG BORING, MILLING and MEASURING MACHINES—will furnish your plant with the permanent means (1) to define, establish and maintain the highest possible precision standards in your manufacturing processes, so as (2) to improve your quality-of-output and economy-of-operation. These and other profit-advantages are interestingly demonstrated in the film offered below.

FREE Showing 16mm. Sound Film

### "PRODUCTION WITH PRECISION"

AMERICAN SIP CORPORATION  
100 East 42 Street, New York 17, N. Y.

Please arrange, with no obligation, for a free group showing at my plant of your 25 minute, 16mm. sound film, "Production with Precision."

NAME \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

# NO, NO...a thousand times "NO"



"**NO** loss of time,"  
say the thousands of users  
of LAMINUM SHIMS...

**NO** machining!



**NO** grinding!



**NO** counting!



**NO** stacking!



**NO** miking!



## LAMINATED SHIMS OF



Laminated Shims of  
**LAMINUM**  
now available in

|   |  |
|---|--|
| STAINLESS<br>STEEL<br>with laminations<br>of .002" or .003" | ALUMINUM<br>with laminations<br>of .003" only                |
| BRASS<br>with laminations<br>of .002" or .003"              | LOW CARBON<br>STEEL<br>with laminations<br>of .002" or .003" |

## LAMINATED SHIM COMPANY, INC.

Shim Headquarters since 1913  
3901 Union Street, Glenbrook, Conn.

**CRANES, Electric Traveling**  
Cleveland Crane & Engrg. Co., Wickliffe, Ohio

### CUTTERS, Keyseating

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.  
DoAll Co., Des Plaines, Ill.  
du Mont Corp., Greenfield, Mass.  
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.  
National Twist Drill Co., Rochester, Mich.  
Star Cutter Co., 34500 Grand River, Farmington, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

### CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.  
Barber-Colman Co., 1300 Rock St., Rockford, Ill.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio  
DoAll Co., Des Plaines, Ill.  
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Goddard & Goddard Co., Detroit, Mich.  
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.  
Haynes Stellite Co., Kokomo, Ind.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Kennametal, Inc., Latrobe, Pa.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Match & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio  
National Twist Drill & Tl. Co., Rochester, Mich.  
Star Cutter Co., 34500 Grand River, Farmington, Mich.  
Tomkins-Johnson Co., Jackson, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

### CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati, Ohio  
Cincinnati Milling and Grinding Mch's., Inc., Cincinnati 9, Ohio  
Cities Service Oil Co., 70 Pine St., New York, N. Y.  
DoAll Co., Des Plaines, Ill.  
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
Match & Merryweather Mchry. Co., Penton Bldg., Cleveland 3, Ohio  
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.  
Shell Oil Co., 50 W. 50th St., New York, N. Y.  
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.  
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.  
Texas Co., 135 E. 42nd St., New York, N. Y.

### CUTTING-OFF MACHINES, Lathe Type

Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Cone Automatic Mch. Co., Windsor, Vt.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Grieder Industries, Inc., Bowling Green, Ohio  
Modern Machine Tool Co., Jackson, Mich.

### CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.  
DoAll Co., Des Plaines, Ill.  
Johnson Mfg. Co., Albion, Mich.  
Norton Co., 1 New Bond St., Worcester 6, Mass.  
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.

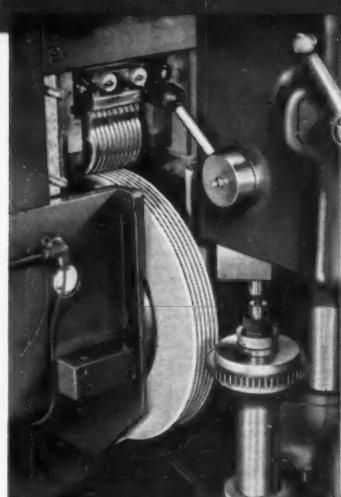
(Continued on page 276)

# High-Precision Gear Production INCREASED 300% on

## SHEFFIELD'S

**NEW  
GEAR  
GRINDER**

MODEL  
140



*Relationship of crushing roll, grinding wheel and work part.*



Precision gears for aircraft, fire control, servo mechanisms, guided missiles, transmissions and machine tools may be ground to a total composite error of less .0005" at production rates three times faster than heretofore possible.

The secret is a fast-cutting grinding wheel accurately crushed true to the basic rack form, operated like a hob and with the work rotating as the teeth are ground—either from the solid hardened blank or a preformed gear. FIELD REPORTS—An aircraft engine manufacturer says "Gears ground on the Model 140 Grinder have passed our surface tempering inspection and show no grinding burns".

A large precision instrument manufacturer, in speaking of the Model 140, writes, "We have inspected gears ground on prominent gear grinders of both American and European manufacture. Our findings have revealed that this machine is by far the most accurate to date."

### MACHINE CAPACITY (Work Gear)

|                               |          |                  |           |
|-------------------------------|----------|------------------|-----------|
| Outside Diameter.....         | Up to 8" | Pitch.....       | 8 to 100  |
| Face Width.....               | Up to 5" | Helix Angle..... | Up to 45° |
| Distance between centers..... | 15"      |                  |           |
|                               |          |                  |           |

For complete information, write to The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 9.

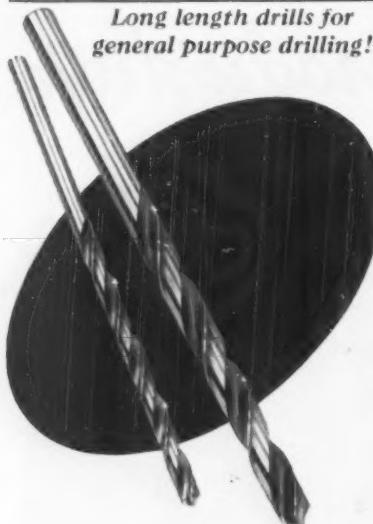
7656



# SHEFFIELD

manufacture and measurement for mankind

*Long length drills for general purpose drilling!*



# ACE

## TAPER LENGTH DRILLS

Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

**NEW CATALOG** covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!



**ACE DRILL**

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

## CUTTING TOOLS—See Tool Material

### CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford, 2, Conn.  
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio  
Logansport Mch. Co., Inc., Logansport, Ind.  
Tomkins-Johnson Co., Jackson, Mich.

### CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.  
Chicago Pneumatic Tool Co., New York 17, N.Y.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio  
Logansport Machine Co., Inc., Logansport, Ind.  
National Forge & Ordnance Co., Irvine, Warren County, Pa.  
Oiltender Co., 1569 W. Pierce St., Milwaukee, Wis.  
Vickers, Inc., Detroit 32, Mich.  
Wilson, K. R., Inc., Arcade, N.Y.

### DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.  
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.  
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio  
Sheffield Corp., Box 893, Dayton 1, Ohio  
Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo.

### DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.

### DIE CASTINGS—See Casting, Die

### DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N.Y.

### DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.  
Donly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
Federal Machine & Welder Co., Overland Ave., Warren, Ohio  
Minster Mch. Co., Minster, Ohio  
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

### DIEING MACHINES

Pratt & Whitney Co., Inc., West Hartford, Conn.

### DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Kennametal Inc., Latrobe, Pa.  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Vascoloy-Ramet Corp., North Chicago, Ill.

### DIE SETS AND DIESMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Donly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.  
U. S. Tool Co., Inc., 255 North 18th St., Amherst, N.J.  
Wales-Strippit Co., No. Tonawanda, N.Y.

**ATLANTA, GA.**  
Scott Machine Tool Co.  
411 Williams St., N.W.

**BIRMINGHAM, ALA.**  
George M. Meriwether  
Industrial Equipment  
1712 Seventh Ave. North

**BOSTON, MASS.**  
Stedfast & Roulston, Inc.  
11 Deerfield St.

**BUFFALO 23, N.Y.**  
Syracuse Supply Co.  
1965 Sheridan Drive

**CHARLESTON, W. VA.**  
Wm. S. Bolden Co., Inc.  
MacCorkle Ave.

**CHATTANOOGA, TENN.**  
Scott Machine Tool Co.

**CHICAGO, ILL.**  
Jackson-Fotsch Co.  
7330 West Lawrence Ave.

**CINCINNATI, O.**  
The E. A. Kinsey Co.  
327-335 W. Fourth St.

**NEW YORK, N. Y.**  
Kearney & Trecker Corp.  
409 Grand Ave.  
Englewood, New Jersey

**NEW ORLEANS, LA.**  
Stouts & Haas, Inc.  
524 Camp St.

**OMAHA, NEB.**  
Fuchs Mach. & Supply Co.  
2401 N. Eleventh St.

**PHILADELPHIA, PENN.**  
Machinery Assoc., Inc.  
325 E. Lancaster Ave.  
Wynnewood, Penna.

**PITTSBURGH, PENN.**  
Kearney & Trecker Corp.  
4 West Manilla Ave.

**PORTLAND, ORE.**  
Harry M. Euler Co.  
2811 N.E. Gilson St.

**RICHMOND, VA.**  
Smith-Courtney Co.  
Seventh & Bainbridge Sts.

For details, contact these

## KEARNEY & TRECKER DISTRIBUTORS

or write to

**KEARNEY & TRECKER CORP.**  
6788 W. National Ave., Milwaukee 14, Wis.

**CLEVELAND, O.**  
Kearney & Trecker Corp.  
Euclid Ave. & E. 17th St.

**COLUMBUS, O.**  
The E. A. Kinsey Co.  
1020 W. Fifth St.

**DALLAS, TEX.**  
Greene Machinery Co.  
6300 Wyche Blvd.

**DAYTON, O.**  
The E. A. Kinsey Co.  
16 Washington St.

**DENVER, COLO.**  
F. J. Leonard Co.  
1219 California St.

**DETROIT, MICH.**  
Kearney & Trecker Corp.  
10600 Furitan Ave.

**GREENSBORO, N. C.**  
Smith-Machinery Co.  
239 S. Davie St.

**HICKORY, N. C.**  
Smith-Courtney Co.  
103 3rd Street, S.W.

**HOUSTON, TEX.**  
Steel & Machine Tool Sales  
6414 Navigation Blvd.

**INDIANAPOLIS, IND.**  
The E. A. Kinsey Co.  
1550 Stadium Drive

**KANSAS CITY, MO.**  
Blackman & Nuetzel  
Machinery Co.  
1103 E. Armour Blvd.

**LOS ANGELES, CALIF.**  
Moore Machinery Co.  
3200 S. Garfield Ave.

**MILWAUKEE, WIS.**  
Kearney & Trecker Corp.  
6784 W. National Ave.

**ROCHESTER 4, N.Y.**  
Syracuse Supply Co.  
311 Alexander Street

**ST. LOUIS, MO.**  
Blackman & Nuetzel  
Machinery Co.  
3713 Washington Ave.

**ST. PAUL, MINN.**  
Sales Serv. Mach. Tool Co.  
2363 University Ave.

**SALT LAKE CITY, UTAH**  
Todd Machinery Co.  
4165 Holloway Drive

**SAN FRANCISCO, CAL.**  
Moore Machinery Co.  
7th & Carleton-Berkeley

**SAN JOSE, CALIF.**  
Moore Machinery Co.  
656 Stockton Ave.

**SEATTLE, WASH.**  
Dawson Mach. Co.  
3700 First Ave., S.

**SHREVEPORT, LA.**  
Peerless Supply Co., Inc.  
701 Spring St.

**SYRACUSE 1, N. Y.**  
Syracuse Supply Co.  
314-332 W. Fayette St.

**TULSA, OKLA.**  
White Star Mach. Co.  
104 Boulder Blvd.  
19 West 10th Street

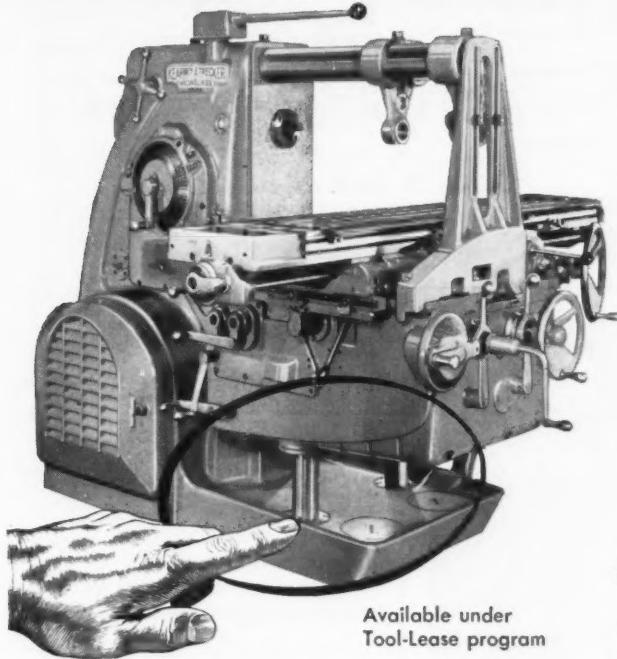
**WICHITA, KAN.**  
White Star Mach. Co.  
301 N. St. Francis

**CANADA**  
MONTREAL  
OTTAWA  
QUEBEC  
TORONTO  
WINDSOR  
Williams & Wilson Ltd.



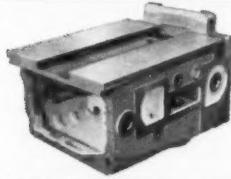
(Continued on page 278)

# COMMON SENSE says it's better...

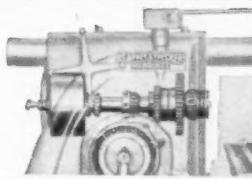


Available under  
Tool-Lease program

## 5 more reasons why **TF** Series milling machines are way out front in rigidity



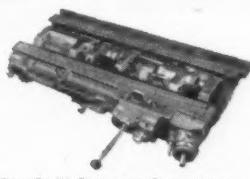
**Heavier, Wider, One-Piece Knee**—The TWIN SCREW arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . lasting accuracy . . . substantial reduction of way and gib wear.



**Three-Bearing Spindle**—Complete assembly consists of three heavy-duty bearings, flywheel, a train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life, better finish and quieter operation.



**Double "Vibra-Void" Overarms**—Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection than any other type support. Design also greatly simplifies changing of arbors and cutters.



**"Front-Trol" Operating Convenience**—Front-mounted controls include feed selection, Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, table handwheel, saddle clamping gib and backlash eliminator. Machines have 2" dia. table feed screw.

# Twin Screw Knee Support

Think it over . . . twin screw knee support is the one really new basic advancement in knee type milling machine design in years.

And only Kearney & Trecker  
new **TF** Series machines have it!

### Here's why it makes sense.

Because the *twin screw* design distributes most effectively the weight of much larger, heavier knees, saddles and tables, it fulfills today's requirements for higher speeds, feeds and power — greater machine capacity. What's more, this *balanced design* substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . divides the wear factor in half, thus assuring greater, longer-lasting accuracy.

Kearney & Trecker's feature-packed TF Series line of general production machines is available in five sizes — No. 2 to No. 6, from 10hp to 50hp in Plain, Universal and Vertical styles.

Why take less than the latest when you want new milling machines? You can get all the facts on the new TF's from your Kearney & Trecker representative, or write direct to Kearney & Trecker Corp. Mail coupon for new catalog with details on TF Series machines.



**Massive Column**—Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.



**KEARNEY & TRECKER CORP.**  
6789 W. National Ave., Milwaukee 14, Wisconsin  
Please send me Catalog No. TF-50 with details on new line of TF Series Plain, Universal and Vertical milling machines.

Name.....  
Title.....  
Company.....  
Address.....  
City..... Zone..... State.....

**KEARNEY & TRECKER**  
**MILWAUKEE**  
BUILDERS OF  
PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

**Product Directory**

**DIE SINKING MACHINES**—See Milling Machines, Die Sinking, etc.

**DIE STOCKS**—See Stocks and Dies

**DIES, Blanking, Forming, Drawing, Extruding, etc.**

Bath, Cyril Co., 32324 Aurora Road, Saline, Ohio  
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio  
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.  
Ferracute Mch. Co., Bridgeton, N. J.  
Metal Carbides Corp., Youngstown, Ohio  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.

Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Ollofsson Corp., Lansing, Mich.  
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.  
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.  
Wales-Strippit Corp., North Tonawanda, N. Y.

**DIES, Lettering and Embossing**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Wales-Strippit Corp., North Tonawanda, N. Y.

**DIES, Self-opening Threading**

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.  
Eastern Mch. Screw Corp., New Haven, Conn.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Jones & Lamson Mch. Co., Springfield, Vt.  
Landis Mch. Co., Waynesboro, Pa.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio

**DIES, Thread Cutting**—See Stocks and Dies

**DIES, Thread Rolling**

Landis Machine Co., Waynesboro, Pa.  
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

**DIES, Wire Drawing**

Vascoloy-Ramet Corp., North Chicago, Ill.

**DISINTEGRATORS**

Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
Elox Corp., Royal Oak 3, Mich.

**DIVIDERS AND TRAMMELS**—See Layout and Drafting Tools

**DIVIDING HEADS**—See Indexing and Spacing Equipment

**DOWEL PINS**

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.  
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
DoAll Co., Des Plaines, Ill.  
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.  
Standard Pressed Steel Co., Jenkintown, Pa.  
U. S. Tool Co., Inc., 255 North 18th St., Amherst, N. J.

**DRAWING COMPOUNDS**

Oakite Products, Inc., 26 Rector St., New York 6.

**DRESSERS, Grinding Wheel**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Ex-Cel-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio  
Metal Carbides Corp., Youngstown, Ohio  
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.  
Norton Co., 1 New Bond St., Worcester, Mass.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

**DRIFT KEYS**

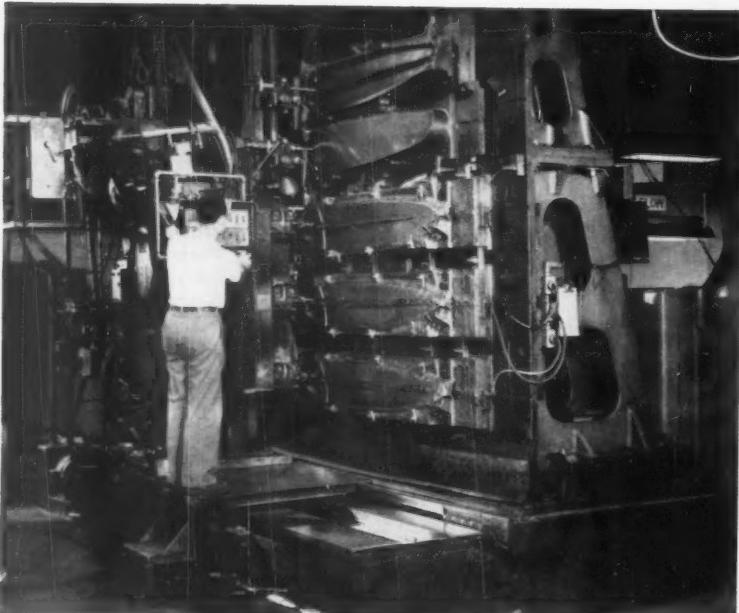
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
DoAll Co., Des Plaines, Ill.  
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILL SLEEVES AND EXTENSION HOLDERS**

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
DoAll Co., Des Plaines, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.

(Continued on page 280)

## Walker Does it Again-



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.

**O. S. WALKER CO. Inc.**  
WORCESTER 6, MASSACHUSETTS  
*Original Designers and Builders of Magnetic Chucks*

IN CANADA—UPTON BRADEEN & JAMES, LTD.

WHEN SMALL PARTS GET  
**SMALLER**  
AND TOLERANCES GET  
CLOSER  
YOU NEED ...

# BECHLER

SWISS AUTOMATICS

When tolerances are too tight, and parts are too slender or intricate to be produced on ordinary screw machines, then Bechler genuine Swiss Automatics are probably what you need. Fifty years of experience have made Bechler the leading builders of Swiss type Automatics—and BECHLERS are SWISS-MADE.

Bechlers do the job quickly, accurately, uniformly, and with exceptionally high finish. Five tool slides, with single-point tools, can be individually adjusted with micrometer screws. The two horizontal slides of the double tool attachment are used for undercutting and burnishing. Different models are available with capacities up to  $1\frac{1}{4}$ " diameter and 9" turning length.

Get in touch with us soon. Find out how Bechler can help you make better products to meet and beat higher and higher standards.

- Service centers in New York and Los Angeles—factory trained men will plan layouts, produce tools, cams, and make set-ups.

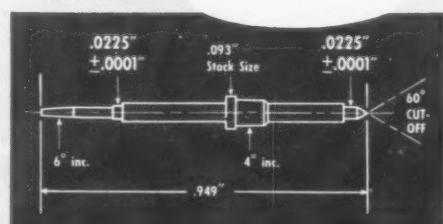
- Complete stock of attachments, spare parts, and cams.

The Bechler Model A-10 can produce many different precision parts up to  $\frac{3}{8}$ " dia.,  $2\frac{3}{4}$ " long. Here are just a few, actual size:



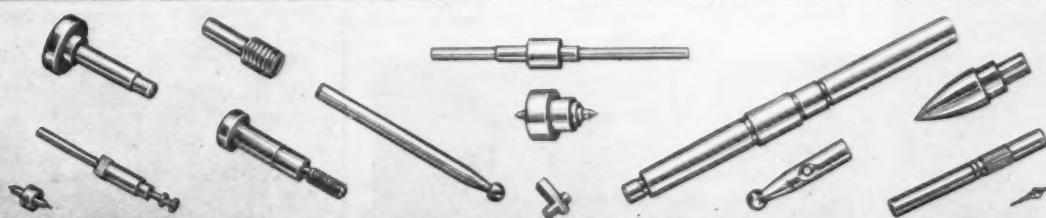
Bechler Model A-10—  
 $\frac{3}{8}$ " capacity.

## INDICATOR SHAFT



Actual  
size

|                            |  |
|----------------------------|--|
| material                   | stainless steel, type 303              |
| precision                  | bearing diameters held to $\pm .0001"$ |
| finish on bearing surfaces | 6 MIRMS                                |
| production time            | 30 seconds per piece                   |
| machine                    | Bechler, Model A-10                    |



# COSA

nationwide sales and service of precision machine tools  
from bench lathes to boring mills.

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

## Product Directory

National Automatic Tool Co., Richmond, Ind.  
National Twist & Tool Co., Rochester, Mich.  
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

**DRILL HEADS, Multiple Spindle**

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.  
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.  
Buffalo Forge Co., Broadway, Buffalo, N. Y.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.  
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.

Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.  
Leland Gifford Co., Box 989, Worcester 1, Mass.  
Michigan Drill Head Co., Van Dyke, Mich.  
National Automatic Tool Co., Richmond, Ind.  
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.  
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.  
United States Drill Head Co., 616 Burns, Cincinnati, Ohio  
Zagar, Inc., 2400 Lakeland Blvd., Cleveland 23, Ohio

Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
Michigan Drill Head Co., Detroit 34, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Rehberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.  
Snow Manufacturing Co., Bellwood, Illinois

**DRILLING AND BORING UNITS, Self-contained**

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Barnes, W. F. & John Co., Rockford, Ill.  
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.  
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.  
Govra-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.  
Homestrand, Inc., Larchmont, N. Y.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.  
Leland-Gifford Co., Box 989, Worcester 1, Mass.  
Michigan Drill Head Co., Van Dyke, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio.  
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
Sheffield Corp., Box 893, Dayton 1, Ohio  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.  
Western Machine Tool Works, Holland, Mich.  
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**DRILLING MACHINES, Automatic**

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Barnes, W. F. & John Co., Rockford, Ill.  
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.  
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.  
Edlund Mohry Co. Div., Cortland, N. Y.  
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.  
Kearney & Trecker Corp., Milwaukee 14, Wis.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.  
Leland-Gifford Co., Box 989, Worcester 1, Mass.  
Michigan Drill Head Co., Van Dyke, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.  
Moline Tool Co., Moline, Ill.  
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio.  
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
Olsson Corp., Lansing, Mich.  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
Snow Manufacturing Co., Bellwood, Ill.  
Townsend, H. P., Mfg. Co., Elmwood, Conn.  
Wales-Strippit Corp., North Tonawanda, N. Y.  
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILLING MACHINES, Bench**

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.  
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

(Continued on page 282)

**Automated Cutting?**

**Use  
CIRCLE R  
CARBIDE  
SAWS!**

In automation, especially where cutting is extra tough, Circle R Carbide Saws mean longer runs, less down time, fewer stoppages for re-sharpening. Rely on our inclusive line, both carbide tipped and solid tungsten carbide.

Consult CIRCLE R Specialists In —

Burbank  
Chicago  
Cleveland  
Dayton  
Detroit

Hackensack  
Indianapolis  
Kansas City  
Milwaukee

New York City  
Philadelphia  
Montreal  
Phoenix

Pittsburgh  
Providence  
Portland  
St. Louis  
Westbury, L. I.

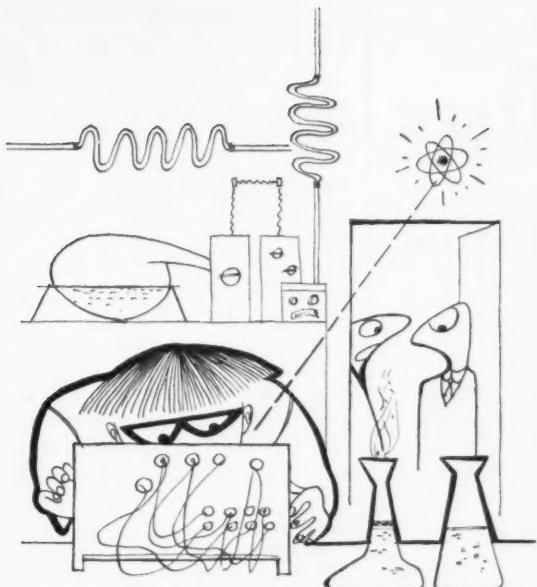
**CIRCULAR TOOL CO., INC.**

PROVIDENCE 5, RHODE ISLAND

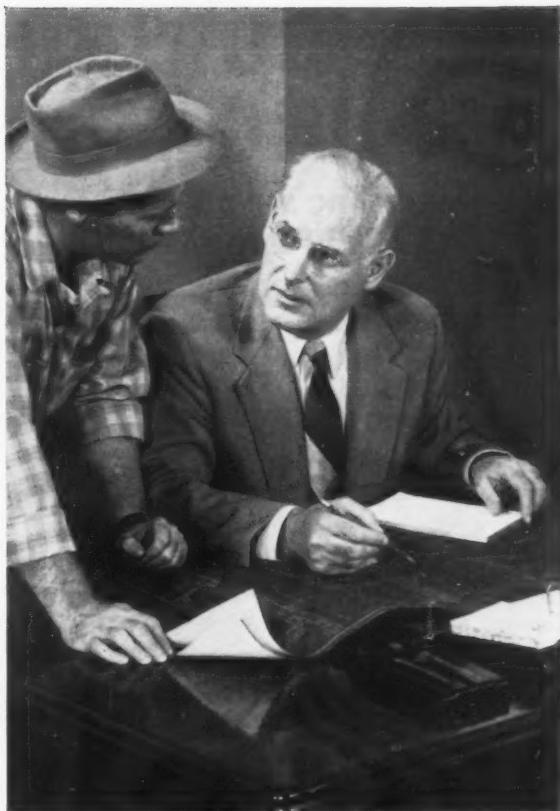
Specialists in Circular Cutting Tools Since 1923

SEND FOR CATALOG D

METAL SLITTING SAWS  
COPPER SLITTING SAWS  
SCREW SLOTTING SAWS  
COPPER BENDING SAWS  
TEFLONERS SLOTTING SAWS  
CUT-OFF SAWS • CIRCULAR  
KNIVES • ROTARY SHEAR  
BLADES • CIRCULAR STEEL  
SAWS • SOLID & TIPPED  
TUNGSTEN CARBIDE SAWS  
COMBINED DRILL & COUNT  
ERSHEDS • CENTER REAMERS



"He just cracked an atom trying to find out what HELLER TOOL is going to announce Feb. 1!"



# DAVIS KEYSEATERS

**QUICK, LOW COST OPERATION** is made possible by the Davis tilting table, which permits even work tapering as much as 3" per foot to be set up and cut quickly. And Davis multiple tooth cutters make quick work of all keyways up to 1" in width.

Let us work out set-ups to speed up your production.

•

Write for Bulletin

**DAVIS  
KEYSEATER  
COMPANY**  
405 EXCHANGE ST.  
ROCHESTER 8, N.Y.

**rush it to CDT**

Get those tough special design jobs off to Columbus Die-Tool for quick action. An outstanding engineering staff backed by 50 years of Company experience can make tough jobs look easy.

Whether it's special tools, jigs, fixtures or even special machinery, you'll find that CDT can build them better, faster and more economically. That's why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool.

Perhaps we can solve your tooling problem and help you make your product... better, for less.

**Columbus Die-Tool  
AND MACHINE COMPANY**

P. O. BOX 750 • COLUMBUS, OHIO  
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • also Builders of Machine Tools Complete

# KBF2 BORING AND MILLING MACHINE

**WITH AUTOMATIC SPINDLE POSITIONING CONTROLLED BY HAND POSITIONER OR PUNCHED CARD SYSTEM**

Preselective automatic positioning anywhere within a 50" x 30" area.

**ELIMINATES JIGS & FIXTURES!**

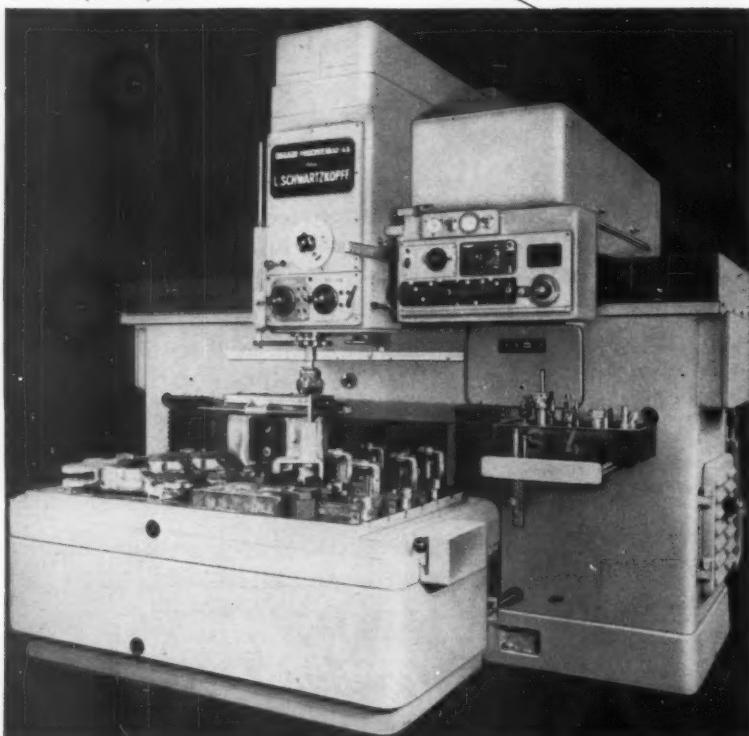
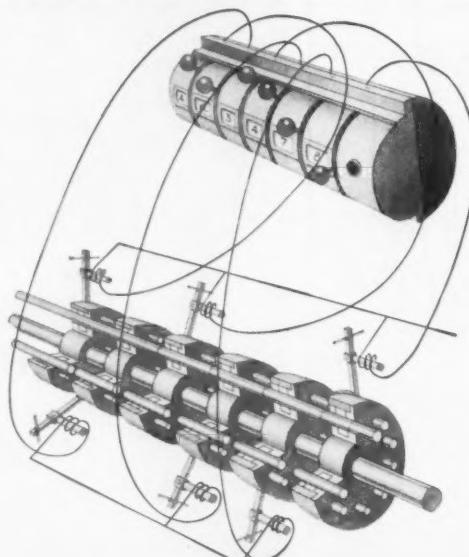
**FOR SINGLE PIECES, SMALL OR LARGE BATCHES**

**NEW!**

Automatic Punch Card control completely eliminates possibility of human error...



...keeps settings for job on "automatic memory" file whenever job is repeated!



For detailed information and literature, contact sole importers:

**MARAC MACHINERY CORP.**  
45 SO. BROADWAY, YONKERS, N.Y. • YOnkers 8-0500

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.  
Edlund Machinery Co. Div., Cortland, N.Y.  
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio  
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio  
Leland-Gifford Co., Box 989, Worcester, Mass.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

#### DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Bausch Machine Tool Co., 15 Wason Ave., Springfield, Mass.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Krueger-Barnes Corp., 1469 E. Grand Blvd., Detroit 11, Mich.  
Leland-Gifford Co., Box 989, Worcester 1, Mass.  
Michigan Drill Head Co., Van Dyke, Mich.  
Morris Machine Tool Co., Inc., 933 Harriet Cincinnati 3, Ohio  
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Wales-Stripit Corp., North Tonawanda, N.Y.

#### DRILLING MACHINES, Gang, Multiple-spindle

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Barnes, W. F. & John Co., Rockford, Ill.  
Bausch Machine Tool Co., 15 Wason Ave., Springfield, Mass.  
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.  
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio  
Consolidated Mch. Tool Corp., Rochester, N.Y.  
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.  
Edlund Machinery Co. Div., Cortland, N.Y.  
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio  
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio  
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.  
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Leland-Gifford Co., Box 989, Worcester, Mass.  
Michigan Drill Head Co., Van Dyke, Mich.  
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.  
Moline Tool Co., Moline, Ill.  
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio  
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
South Bend Lathe Works, South Bend 22, Ind.  
Western Machine Tool Works, Holland, Mich.

#### DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio  
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio  
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio  
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio  
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio  
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
Cosa Corp., 405 Lexington Ave., New York 17, N.Y.  
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio  
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio  
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N.Y.  
Western Machine Tool Works, Holland, Mich.

#### DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.  
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.

(Continued on page 284)

# 118 feet of automation—

performs machine operations on bank surfaces, valve lifter holes and distributor hole of V-8 engine block.

Outstanding features in this long transfer make it extremely practical, efficient and trouble-free.

Idle stations permit tooling and inspection of parts through hinged gates. Jointed transfer bar between work stations permits easy and accurate line-up of machine units. Fixtures are rugged and designed to give maximum accessibility to bushing plates.

Tell-tale lights on control panel assist in locating and clamping of parts at each work station. Automatic lubrication, with pump at each work station, is combined with tell-tale lights to warn of malfunction at that station.

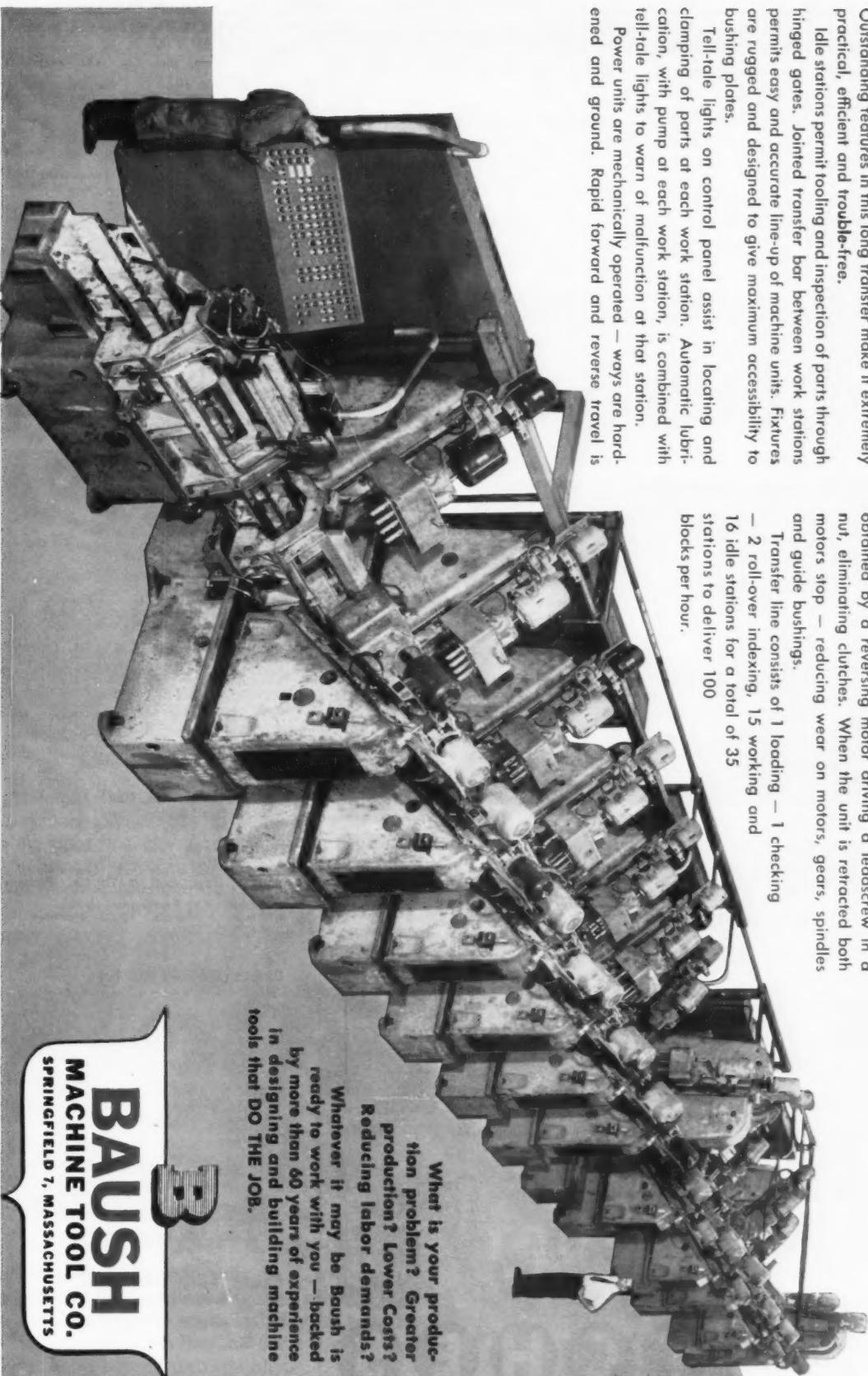
Power units are mechanically operated — ways are hardened and ground. Rapid forward and reverse travel is

obtained by a reversing motor driving a leadcrew in a nut, eliminating clutches. When the unit is retracted both motors stop — reducing wear on motors, gears, spindles and guide bushings.

Transfer line consists of 1 loading — 1 checking

— 2 roll-over indexing, 15 working and 16 idle stations for a total of 35

stations to deliver 100 blocks per hour.



What is your production problem? Greater production? Lower Costs? Reducing labor demands? Whatever it may be Baush is ready to work with you — backed by more than 60 years of experience in designing and building machine tools that DO THE JOB.

**BAUSH**  
MACHINE TOOL CO.  
SPRINGFIELD 7, MASSACHUSETTS

For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—283

## Product Directory

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
 Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
 Cincinnati Bickford Div., Oakley, Cincinnati, Ohio  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.  
 Edlund Machinery Co. Div., Cortland, N. Y.  
 Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio  
 Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio  
 Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio  
 Leland-Gifford Co., Box 989, Worcester, Mass.  
 Levin & Son, Inc., Louis, 3610 So. Broadway,  
 Los Angeles 7, Calif.  
 National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.  
 Snow Manufacturing Co., Bellwood, Illinois

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Townsend, H. P., Mfg. Co., Elmwood, Conn.  
 Wales-Strippit Corp., North Tonawanda, N. Y.  
 Western Machine Tool Works, Holland, Mich.

## DRILLING MACHINES, Upright

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.  
 Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
 Barnes, W. F. & John Co., Rockford, Ill.  
 Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
 Cincinnati Bickford Div., Oakley, Cincinnati, Ohio  
 Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Etco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.

Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio  
 Homestrand, Inc., Larchmont, N. Y.  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Michigan Drill Head Co., Van Dyke, Mich.  
 National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.  
 Rehner-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.  
 Snow Manufacturing Co., Bellwood, Ill.  
 South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
 Wales-Strippit Corp., North Tonawanda, N. Y.  
 Western Machine Tool Works, Holland, Mich.

## DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
 Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.  
 Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio  
 DoAll Co., Des Plaines, Ill.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 National Twist Drill & Tool Co., Rochester, Mich.  
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

## DRILLS, Core

Ace Drill Corp., Adrian, Mich.  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
 Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
 DoAll Co., Des Plaines, Ill.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 National Twist Drill & Ti. Co., Rochester, Mich.  
 Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.  
 Star Cutter Co., 34500 Grand River, Farmington, Mich.  
 Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

## DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 National Twist Drill & Ti. Co., Rochester, Mich.  
 Star Cutter Co., Farmington, Mich.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

## DRILLS, Oil Hole, Oil Tube

Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.  
 Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.  
 Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
 DoAll Co., Des Plaines, Ill.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 National Twist Drill & Ti. Co., Rochester, Mich.  
 Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

## DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.  
 Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
 Thor Power Tool Co., Aurora, Ill.

## DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.  
 Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
 Thor Power Tool Co., Aurora, Ill.

(Continued on page 286)

## ROCKFORD

PULLMORE



MULTIPLE-DISC

# LONG WEAR LIFE

COMPACT DESIGN

HIGH TORQUE

HIGH-RATIO LEVERS

POSITIVE NEUTRAL

PRECISION BUILT

LONG WEAR LIFE \*

EASY ADJUSTMENT

\* Heat-treated alloy steel provides wear-resisting bearing surfaces that are machined to close tolerances. The shifter spool has a deep slot, hardened and ground, which prolongs clutch life and reduces shifter fork wear. Discs have flat, true surfaces, free from high or low spots. Thus operating conditions remain uniform, even after long service.

## Send for This Handy Bulletin

Shows typical installations of **ROCKFORD CLUTCHES** and **POWER TAKE-OFFS**. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.



**ROCKFORD CLUTCH DIVISION** BORG-WARNER  
 ▲ 410 Catherine Street, Rockford, Illinois, U.S.A. ▲

## CLUTCHES

# *Now! Four complete lines!*

# Thor right angle air tools

## Capacity range—No. 12 to $\frac{3}{4}$ " nuts

**NEW NO. 4 SERIES SPECIALLY  
DESIGNED FOR HEAVY DUTY**



### LIGHT DUTY WORK

Lightweight Thor No. 2 series right angle air nut setter makes this assembly job quick, sure and easy on the operator. No. 2 series includes tools up to  $\frac{1}{4}$ " capacity—and is available with an offset or lever throttle. Also a wide range of accessories.



### CLOSE-QUARTER WORK

Getting at those hard-to-work areas is no problem for this Thor right angle nut setter. This tool is from the Thor No. 3 series which includes nut setters up to  $\frac{5}{16}$ " capacity. All Thor nut setters and screwdrivers have built-in air regulators.

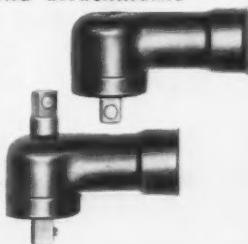


### HEAVY DUTY WORK

Thor's newest entry in the direct drive right angle air tool field is the No. 4 heavy duty series. All new, the No. 4 series offers extra power, light weight and long trouble-free life.

### All Thor right angle nut setters available in single or double end attachments

You can apply nuts or remove them with any of the tools in the Thor No. 2, 3, 4, and 5 series. Equipped with double end attachments, one end applies nuts—the other removes them.



Thor's flexibility goes even further. All four right angle tool series, in single and double end, offer a heavy duty attachment and a close quarter attachment—plus a complete range of speeds in all sizes and types. Thor has right angle air tools which can be adapted to most any application involving threaded fasteners. Thor Power Tool Company, Aurora, Illinois.

**THOR POWER TOOL COMPANY**

Branches in all principal cities



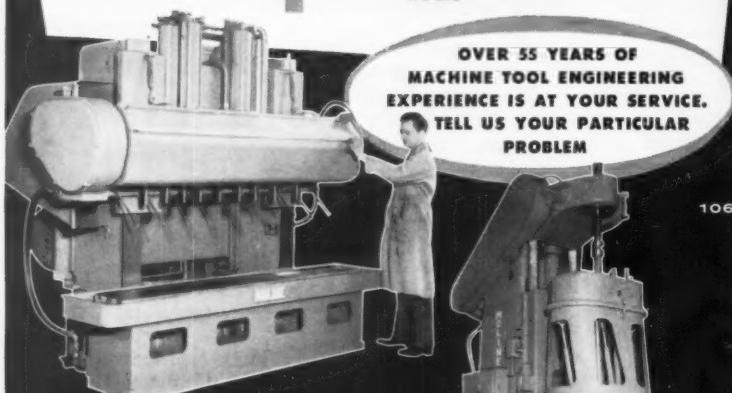
MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.

## For Greater PRODUCTION... EFFICIENCY... SAVINGS

**Use an individually designed "Hole-Hog" Machine Tool for such jobs as...**

- ◆ Multi-Spindle Boring
- ◆ Single and Multi-Spindle Honing
- ◆ Straight Line Multi-Drilling
- ◆ Adjustable Spindle Drilling
- ◆ Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- ◆ Special Multiple Operation Machine Tools

OVER 55 YEARS OF  
MACHINE TOOL ENGINEERING  
EXPERIENCE IS AT YOUR SERVICE.  
TELL US YOUR PARTICULAR  
PROBLEM



HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.

No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral top drivers plus four-speed quick change gear box. Spindles illustrated are 1½" drill capacity each in mild steel.



**MOLINE TOOL COMPANY**

REPRESENTATIVES IN PRINCIPAL CITIES

100 20TH STREET • MOLINE, ILLINOIS

## Product Directory

### DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Subland

Ace Drill Corp., Adrian, Mich.  
Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
DoAll Co., Des Plaines, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Star Cutter Co., 34500 Grand River, Farmington, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
DoAll Co., Des Plaines, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Thor Power Tool Co., 175 N. State St., Aurora, Ill.  
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Twist, Carbide, Carbide-tipped

Ace Drill Corp., Adrian, Mich.  
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
DoAll Co., Des Plaines, Ill.  
Heller Tool Co., Newcomerstown, Pa.  
National Twist Drill & Tool Co., Rochester, Mich.  
Thor Power Tool Co., 175 N. State St., Aurora, Ill.  
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

### DRILLS, Wire

Ace Drill Corp., Adrian, Michigan  
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.  
Cleveland Twist Drill Co., Cleveland, Ohio  
Greenfield Tap & Die Corp., Greenfield, Mass.  
National Twist Drill & Tool Co., Rochester, Mich.  
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

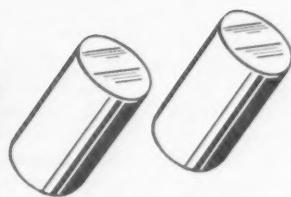
### DUPLICATING ATTACHMENTS—See Tracing Attachments

### DUST COLLECTORS AND CONTROL SYSTEMS

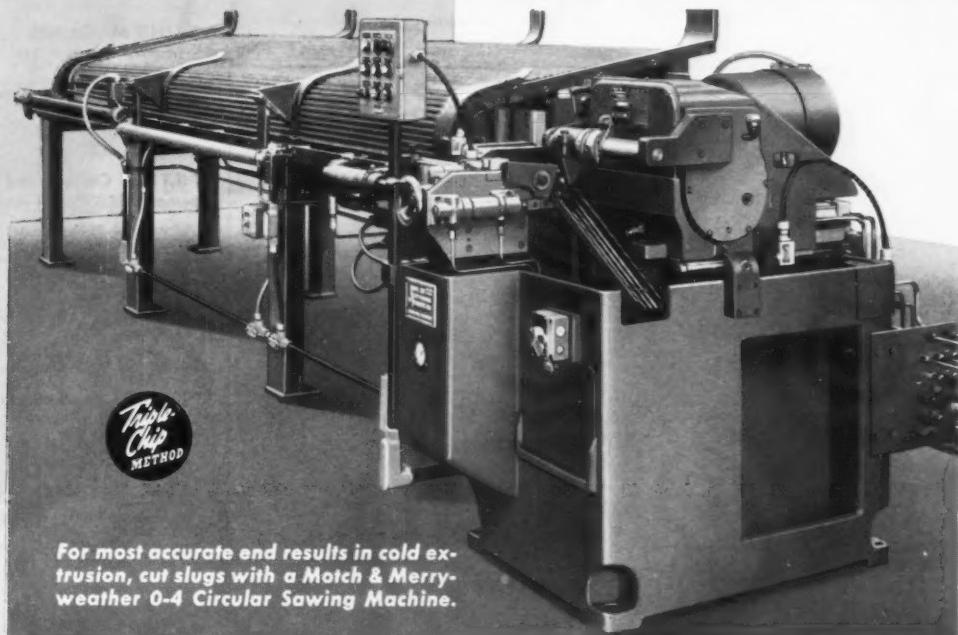
Brown & Sharpe Mfg. Co., Providence, R. I.  
Pangborn Corp., Hagerstown, Md.  
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

(Continued on page 288)

cold cuts



BY MOTCH & MERRYWEATHER



. . . make better COLD EXTRUDED PARTS



The Motch & Merryweather No. 0-4 Precision Circular Sawing Machine is automatic from the storage table to the finished cut slug. It cuts slugs accurate to  $\pm .002"$  with uniformly square ends and minimum burr. Give your cold extrusion press the opportunity of producing more work than ever before, with more accuracy than ever before, at a lower cost per piece than ever before.

THE  
**MOTCH & MERRYWEATHER**  
**MACHINERY CO.**

MACHINERY MANUFACTURING DIVISION  
CLEVELAND 13, OHIO

*Builders of Automatic Precision Cut-Off, Milling and Special Machinery*

**ELECTRICAL DISCHARGE MACHINES**

—See Disintegrators

**ENGRAVING MACHINES**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Gorton, Geo., Mach., 1321 Racine St., Racine Wis.  
 Green Instrument Co., Cambridge, Mass.

**EXTRACTORS, Screw**

Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.  
 Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

**FACING HEADS**

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
 Cross Co., 3250 Bellevue, Detroit 7, Mich.  
 Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
 Giddings & Lewis Mch. Tool & Co., Fond du Lac, Wis.  
 Michigan Drill Head Co., Van Dyke, Mich.  
 Mumford-Dixon Co., Hanover, Pa.

**FANS, Exhaust, Ventilating**

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

**FELT, For All Applications**

American Felt Co., Glenville, Conn.

**FILES, Band**

DoALL Co., Des Plaines, Ill.

**FILES, General-purpose, Swiss Pattern**

DoALL Co., Des Plaines, Ill.  
 Heller Tool Co., Newcomerstown, Ohio  
 Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

**FILES AND BURRS, Rotary**

DoALL Co., Des Plaines, Ill.  
 Heller Tool Co., Newcomerstown, Ohio  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Simonds Saw & Steel Co., Fitchburg, Mass.  
 Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**FILING MACHINES**

Chicago Pneumatic Tool Co., New York 17, N. Y.  
 DoALL Co., Des Plaines, Ill.  
 Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

**FILTERS, Coolant and Oil**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
 Commercial Filters Corp., Lebanon, Ind.  
 DeLaval Separator Co., Poughkeepsie, N. Y.  
 Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.  
 Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.  
 Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

**FINISHES, Machine and Metal**

Lowe Bros. Co., Dayton, Ohio

**FLAME-HARDENING MACHINES**

Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.

**FORGING HAMMERS, Steam and Air**

Chambersburg Engrg. Co., Chambersburg, Pa.  
 Erie Foundry Co., Erie, Pa.

**FORGING, Machines, Headers, Upsetters**

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio  
 Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

**FORGINGS, Drop**

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.  
 Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.  
 Mueller Brass Co., Port Huron 35, Mich.  
 Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**FORGINGS, Hollow-Bored**

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.  
 Mueller Brass Co., Port Huron, Mich.  
 National Forge & Ordnance Co., Irvine, Warren County, Pa.

**FORGINGS, Press**

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.  
 Bridgeport Brass Co., Bridgeport, Conn.  
 Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
 Forquhar Div., A. B., 142 N. Duke St., York, Pa.  
 Minster Mch. Co., Minster, Ohio  
 Mueller Brass Co., Port Huron, Mich.

(Continued on page 290)

for all-around use in many applications

**FERRACUTE combination  
ADJUSTABLE  
BED & KNEE PRESS**

WRITE FOR COMPLETE DETAILS

Available in 75-ton to 200-ton models

**FERRACUTE MACHINE COMPANY**

East Commerce Street, Bridgeton, N. J.

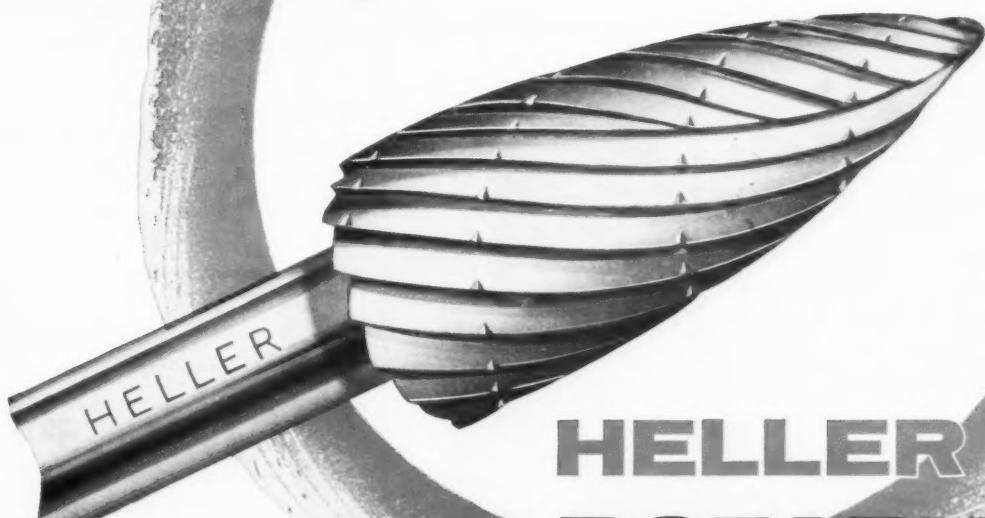
Since 1863, Manufacturers of Power Presses,

Press Brakes and Special Machinery

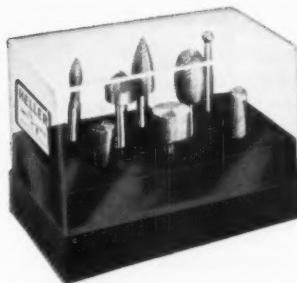
**FERRACUTE**

CAG-200  
200-ton model  
with bed removed

get longer life with



## HELLER ROTARY FILES



Popular Assortments of HELLER  
Rotary Files available in four  
different combinations of Hand  
Cut and Ground-From-Solid.



Special analysis, high quality steel, plus precision manufacture make each HELLER Rotary File last longer—and cut faster. HELLER'S Regrinding Service restores them to service at a fraction of their original cost—thereby extending their useful life and saving you money.

Available in a full range of shapes and sizes, HELLER'S complete line includes Handcut, Ground-from-solid, Carbide Burr and Miniatures.

For more than 100 years HELLER has been first in files. Now you can get HELLER quality in any type of file you need.

Write for Catalog R-48 for Rotary File information.

# HELLER TOOL CO.

A Subsidiary of Simonds Saw and Steel Co.

NEWCOMERSTOWN, OHIO

Branch Offices: New York • Detroit • Chicago • Los Angeles

**YOUR HELLER DISTRIBUTOR CAN  
SUPPLY ALL YOUR FILE NEEDS**

National Forge & Ordnance Co., Irvine, Warren County, Pa.  
Revere Cooper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)  
U. S. Steel Corp., Pittsburgh, Pa.

**FORGINGS, Upset**

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.  
New Departure Div., Bristol, Conn.  
Vanadium-Alloys Steel Co., Latrobe, Pa.  
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**FORMING MACHINES, Cold-rolling**

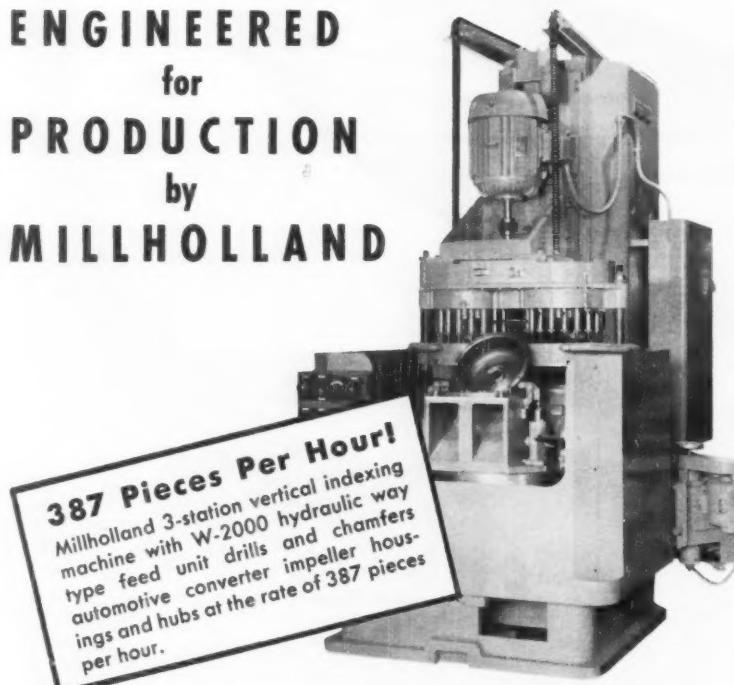
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio  
Ferracute Machine Co., Bridgeton, N. J.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg Co., Mount Gilead, Ohio  
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.  
Yoder Co., 5500 Walworth, Cleveland, Ohio

**FORMING MACHINES, Multiple-slide**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio  
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.  
Nilson, A. H. Machine Co., Bridgeport, Conn.  
U. S. Tool Co., Inc., 255 North Main St., Amherst, N. J.

# ENGINEERED for PRODUCTION by MILLHOLLAND



Typical of Millholland engineering for production, this vertical indexing machine is equipped with a 36-spindle multiple head of ball-bearing construction spanning stations 2 and 3. All spindles have adjustable slip sleeves. Bushing plate registers on the fixture to insure consistent accuracy. The multiple head is driven by a 15 H.P. motor. The cycle is completely automatic; the operator unloads and loads the part in the fixture and presses the button initiating the cycle of the 36-inch automatic index table.

Millholland units, plus Millholland engineering give you standard machine flexibility and economy combined with the efficiency and accuracy of special purpose machines. Millholland designs and builds machines and fixtures to solve a wide range of production problems. Let us show you how we can help you combine, simplify and speed up any combination of rotary tool operations.

**Write for Bulletin M-1 giving complete specifications**

**Let Millholland Multiply Your Production**

**W. K. MILLHOLLAND MACHINERY CO.**  
**6402 Westfield Blvd.**      **Indianapolis 20, Indiana**

**FORMING TOOLS or Tool Blanks**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York  
Kennametal, Inc., Latrobe, Pa.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**FURNITURE, Shop**

Standard Pressed Steel Co., Jenkintown, Pa.

**GAGE BLOCKS**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

**GAGES, Air Comparator**

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, Automatic Sorting**

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

**GAGES, Dial, Bore, Height, Depth, Thread, Groove, etc.**

Ames, B. C., Co., Waltham 54, Mass.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
Comtor Co., 47 Farwell St., Waltham 54, Mass.  
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.  
DoALL Co., Des Plaines, Ill.  
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Standard Gage Co., Inc., Poughkeepsie, N. Y.  
Starrett, The L. S. Co., Athol, Mass.

**GAGES, Electric Comparator**

Brown & Sharpe Mfg. Co., Providence, R. I.  
DoALL Co., Des Plaines, Ill.  
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.  
General Electric Co., Schenectady, N. Y.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, Grinding**

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

**GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness**

Brown & Sharpe Mfg. Co., Providence, R. I.

**GAGES, Multiple Inspection**

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.  
Pratt & Whitney Co., Inc., West Hartford, Conn.  
Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, Plug and Ring**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.  
DoALL Co., Des Plaines, Ill.

(Continued on page 292)

ONE OF A SERIES

## You Get Many Benefits By Specifying **VICKERS** Hydraulics

### Reduced Maintenance Costs

Vickers Oil Hydraulic Equipment is built to minimize maintenance . . . has an outstanding performance record. Nevertheless, Vickers recognizes that sooner or later any piece of machinery requires overhaul. So we have developed a service department of exceptional efficiency . . . one that is convenient for you by reason of full time factory-trained service men working out of our offices from coast to coast.

Showed below are several of the practical aids provided to assure you quick and economical service on Vickers Hydraulics.

#### VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

ADMINISTRATIVE and ENGINEERING CENTER

Department 1403 • Detroit 32, Michigan

*Application Engineering Offices:*

ATLANTA • CHICAGO • CINCINNATI • CLEVELAND  
DETROIT • GRAND RAPIDS • HOUSTON • LOS  
ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW  
YORK AREA (Summit, N. J.) • PHILADELPHIA AREA  
(Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND,  
ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO  
AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA  
WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto



#### SPARE PARTS RECOMMENDATIONS

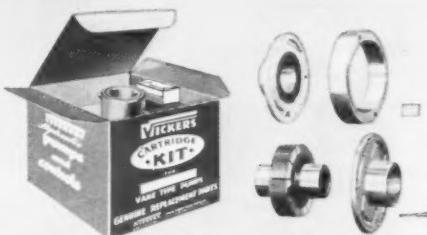
Our service men will study your situation and make practical recommendations on your spare parts inventory . . . will check your inventory and provide you with printed lists of parts usually required.



#### PREVENTIVE MAINTENANCE

Our service men will gladly set up for you an effective program of preventive maintenance on a timetable basis. This avoids costly down time and keeps maintenance costs at a minimum.

7143



#### SERVICE KITS

Packaged repair kits for many Vickers products are available. These provide all needed parts for quick repair in the field and at minimum cost. In addition, these kits simplify stock problems by reducing the number of loose parts.



#### SERVICE SCHOOL

Vickers maintains a Hydraulics Training School for engineering, maintenance and service personnel of both original equipment manufacturers and their customers. For further information, please contact Product Service Department directly.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

**GAGES, Tap & Die**  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Sheffield Corp., Box 893, Dayton 1, Ohio  
 Standard Gage Co., Inc., Poughkeepsie, N. Y.  
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.  
 Van Keuren Co., Watertown, Mass.  
 Winter Bros. Co., Rochester, Mich.

**GAGES, Pressure, Air and Hydraulic**  
 Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

**GAGES, Roll Thread Snap, Adjustable Snap**  
 Federal Products Corp., 1144 Eddy St., Providence 1, R. I.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Sheffield Corp., Box 893, Dayton 1, Ohio  
 Standard Gage Co., Inc., Poughkeepsie, N. Y.  
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

**GAGES, Surface Roughness**  
 DoALL Co., Des Plaines, Ill.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, Vernier, Height, Depth, Gear Tooth**  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoALL Co., Des Plaines, Ill.  
 Federal Products Corp., 1144 Eddy St., Providence 1, R. I.  
 Starrett Co., L. S., Athol, Mass.

#### GASKETS

Garlock Packing Co., Palmyra, N. Y.  
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.

#### GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

#### GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
 Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
 Modern Industrial Engng. Co., 14230 Birwood, Detroit 4, Mich.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

#### GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.  
 Fellows Gear Shaper Co., Springfield, Vt.  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
 Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
 National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### GEAR CUTTING MACHINES Bevel and Spiral

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
 Lees-Bradner Co., Cleveland, Ohio  
 New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.  
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

#### GEAR GRINDERS—See Grinding Machines, Gear

#### GEAR HOBBERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.  
 Barber-Colman Co., 1300 Rock St., Rockford, Ill.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Fellows Gear Shaper Co., Springfield, Vt.  
 Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio  
 Lees-Bradner Co., Cleveland, Ohio  
 Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

#### GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.



**CHAIN CONVEYOR:** It carries blanks, from the blanking press, to the stacker.

**AUTOMATIC STACKER:** Its cycle is controlled by the height of the stack. Gates are air operated and actuated by limit switches. A springloaded cam on the center shuttle bar, when actuated, permits a pusher dog to go into operation—pushing the stack, from the stacker, to the storage shuttle. During the unloading operation, new blanks entering the stacker, are held in preload position by retractable fingers. It's fully automatic!

**STORAGE SHUTTLE:** It's a storage space for the stacks, while they await their turn to be fed automatically to the secondary presses. And it's operated by a motor and a reducer, mounted beside the shuttle bar. It can be built to any desired length.

**THE OUTSTANDING FEATURE:** The chain conveyor, and the storage shuttle, are separately operated. Therefore, downtime on one press never interferes with the production on the other presses.

**MPE** MICHIGAN PRODUCTION ENGINEERING CO.  
*Engineering and Manufacturing*  
 1796 E. 9 Mile Road • Hazel Park, Michigan

**G****Product Directory****GEAR LAPERS**

Fellows Gear Shaper Co., Springfield, Vt.  
Cleason Works, 1000 University Ave., Rochester 3, N.Y.  
Michigan Tool Co., 7171 E. McNichols Rd.,  
Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean,  
Detroit 2, Mich.

**GEAR MOTORS—See Speed Reducers****GEAR RACKS**

Gear Specialties, Inc., 2635 W. Medill Ave.,  
Chicago 47, Ill.  
Illinois Gear & Mch. Co., 2108 No. Natchez  
Ave., Chicago 35, Ill.  
Russell, Holbrook & Henderson, Inc., 292 Madison  
Ave., New York 17, N.Y.  
Stahl Gear & Mch. Co., The, 3901 Hamilton  
Ave., Cleveland 4, Ohio

**GEAR SHAPERS**

Fellows Gear Shaper Co., Springfield, Vt.  
Michigan Tool Co., 7171 E. McNichols Rd.,  
Detroit 12, Mich.

**GEAR SHAVERS**

Fellows Gear Shaper Co., Springfield, Vt.  
Michigan Tool Co., 7171 E. McNichols Rd.,  
Detroit 12, Mich.  
National Broach & Mch. Co., 5600 St. Jean  
Ave., Detroit 2, Mich.

**GEARS, AND GEAR BLANKS, Non-metallic**

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.  
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio  
Diefendorf Gear Corp., Box 934, Syracuse, N.Y.  
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.  
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio  
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.  
New Jersey Gear & Mfg. Co., Hillside, N.J.  
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.  
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.  
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

**GEARS, Cut**

Automotive Gear Works, Inc., South 8th & O St., Richmond, Ind.  
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.  
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio  
Diefendorf Gear Corp., Box 934, Syracuse, N.Y.  
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.  
Farrel-Birmingham Co., Inc., Ansonia, Conn.  
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.  
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio  
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio  
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N.J.  
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.  
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**GENERATORS, Electric**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
General Electric Co., Schenectady, N.Y.  
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

**GRADUATING MACHINES**

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

**GREASES—See Lubricating Oils and Greases**

**GRINDERS, Bench, Floor and Snag**

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.

Jones & Lamson Mch. Co., Springfield, Vt.

Mummert-Dixon Co., Hanover, Pa.

National Alum. Co., 170 E. 131st St., Cleveland 8, Ohio

South Bend Lathe Works, South Bend 22, Ind.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

Thor Power Tool Co., 175 N. State St., Aurora, Ill.

U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

**GRINDERS, Carbide Tool**

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.

Eloy Corp. of Mich., Royal Oak 3, Mich.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Hedlin Machine Co., 10 New Bond St., Worcester 6, Mass.

Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.

Norton Co., 1 New Bond St., Worcester 6, Mass.

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.



Recent design change provides a simple homing device as a standard component of the

**HAMILTON  
SUPER SENSITIVE, SMALL-HOLE  
PRECISION  
TAPPING MACHINE**

and makes routine of such problem work as the tapping of precision holes in thin metal sheets or in brittle plastics. Even improves performance in the tapping of blind holes!

**YOU**

will want full information about this important development!

WE WILL FURNISH IT

**FREE**

ask for

**BULLETIN No. 2463**

+ ADDRESS

**THE HAMILTON TOOL COMPANY**

834 South Ninth Street  
HAMILTON, OHIO



2463

**GRINDERS, Die and Mold**

Norton Co., 1 New Bond St., Worcester 6, Mass.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**GRINDERS, Drill Point**

Atlas Press Co., 20108 N. Pitcher, Kalamazoo Mich.  
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

**GRINDERS, Face Mill**

Kearny & Trecker Corp., Milwaukee 14, Wis.  
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**GRINDERS, Knife and Shear**

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
Mattison Machine Works, Rockford, Ill.  
Mummert-Dixon Co., Hanover, Pa.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**GRINDERS, Portable Electric**

Chicago Pneumatic Tool Co., New York 17, N. Y.  
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
Standard Electrical Tool Co., 2488-90 River Cincinnati 4, Ohio  
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

**GRINDERS, Portable Pneumatic**

Chicago Pneumatic Tool Co., New York 17, N. Y.  
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
Madison-Kipp Corp., Madison, Wis.  
Thor Power Tool Co., Aurora, Ill.

**GRINDERS, Tap**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

**GRINDERS, Tool and Cutter**

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.  
Barber-Colman Co., Rock and Montague, Rockford, Ill.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling and Grinding Mch's., Cincinnati 9, Ohio  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.  
Elco Corp. of Mich., Royal Oak 3, Mich.  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.  
Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.  
Homestrand, Inc., Larchmont, N. Y.  
Landis Tool Co., Waynesboro, Pa.  
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
Mummert-Dixon Co., Hanover, Pa.  
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio  
Norton Co., 1 New Bond St., Worcester 6, Mass.  
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
South Bend Lathe Wks., South Bend 22, Ind.  
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

**GRINDERS, Toolpost**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**GRINDING GAGES**—See Gages, Grinding

**GRINDING MACHINES, Abrasive Belt**

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
Mattison Mch. Works, Rockford, Ill.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio  
Thor Power Tool Co., 175 N. State St., Aurora, Ill.  
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**GRINDING MACHINES, Broach**

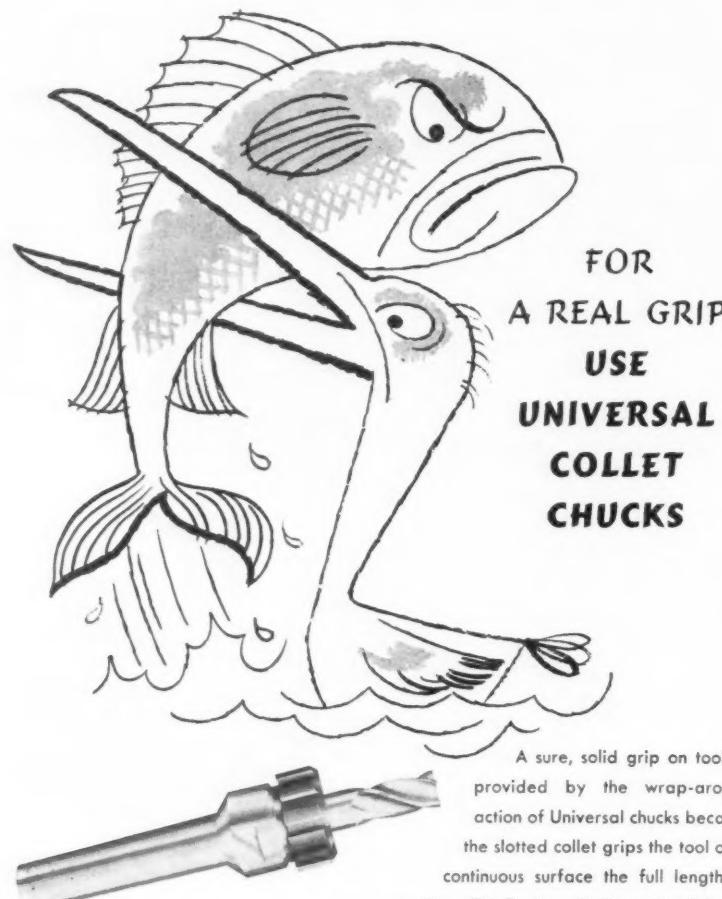
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.  
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.  
National Broach & Mch. Co., 5600 St. Jean Detroit 13, Mich.  
Thompson Grinder, 1534 W. Main, Springfield, Ohio

**GRINDING MACHINES, Cam**

Landis Tool Co., Waynesboro, Pa.  
Norton Co., 1 New Bond St., Worcester 6, Mass.  
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

**GRINDING MACHINES, Centerless**

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
Cincinnati Milling and Grinding Mch's., Inc., Cincinnati 9, Ohio



A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. Tools can't slip and tool shanks

don't get scored. Even tool stubs and broken drills can be used successfully. Sizes range from  $\frac{1}{16}$ " to  $1\frac{1}{2}$ ", with shanks to fit dry machine. Simplified design results in low chuck cost to you. Write today for new "complete line" catalog.



199

**UNIVERSAL ENGINEERING CO.** FRANKENMUTH 2, MICHIGAN

**G****Product Directory**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Head Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Landis Tool Co., Waynesboro, Pa.  
 Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.  
 Van Norman Co., Springfield, Mass.

**GRINDING MACHINES, Crankshaft**

Landis Tool Co., Waynesboro, Pa.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Van Norman Mch. Co., Springfield, Mass.

**GRINDING MACHINES, Cylindrical**

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Frauenthal Div., Muskegon, Mich.  
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.  
 Landis Tool Co., Inc., Waynesboro, Pa.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Sheffield Corp., Box 893, Dayton 1, Ohio  
 Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio  
 Van Norman Co., 2640 Main St., Springfield 7, Mass.

**GRINDING MACHINES, Disc**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.  
 Gardner Machine Co., Beloit, Wis.  
 Mattison Machine Works, Rockford, Ill.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**GRINDING MACHINES, Gear**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.  
 Gleason Works, 1000 University Ave., Rochester 3, N. Y.  
 Lees-Bradner Co., Cleveland, Ohio  
 National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
 Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

**GRINDING MACHINES, Internal**

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.  
 Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Frauenthal Div., Muskegon, Mich.  
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.  
 Head Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio  
 Van Norman Mch. Co., Springfield, Mass.  
 Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

**GRINDING MACHINES, Jig**

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio  
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.  
 Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

**GRINDING MACHINES, Profile**

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio  
 Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Jones & Lamson Mch. Co., Springfield, Vt.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

**GRINDING MACHINES, Roll**

Landis Tool Co., Waynesboro, Pa.

**GRINDING MACHINES, Surface Reciprocating**

Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
 Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.  
 DoAll Co., Des Plaines, Ill.

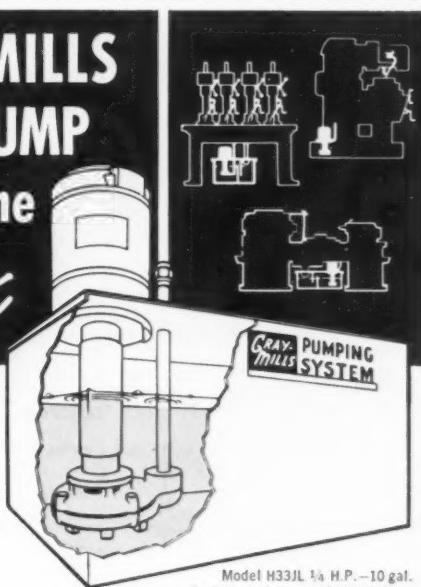
Elox Corp. of Mich., Royal Oak 3, Mich.  
 Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio  
 Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.  
 Gardner Machine Co., Beloit, Wis.  
 Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
 Homestrand, Inc., Larchmont, N. Y.  
 Mattison Machine Works, Rockford, Ill.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Reid Bros. Co., Inc., Beverly, Mass.  
 Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio  
 Van Norman Mch. Co., Springfield, Mass.

**GRINDING MACHINES, Surface Rotary**

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)  
 Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.

(Continued on page 296)

**put a GRAYMILLS COOLANT PUMP on that machine and Relax**



1. They're Dependable—Superflo models require no service

2. Abrasive Proof—No bearings, seals or packings to wear

3. Abundant Volume—of coolant or oil, year after year

4. Standard NEMA Motors—extra power for peak loads

Model H33JL 1/4 H.P.—10 gal. tank, complete . . . \$119.00 from your distributor. Also JIC Model.

Yes, you'll get smooth, steady performance, at less cost, with Graymills pumps or units for original equipment, replacement or conversion. That's why more and more machine tool builders are using Graymills. You'll like the personal services too, they are sold by leading Industrial Distributors and Graymills representatives near you are ready to help with special problems. Specify "GM" pumps—install 'em—forget 'em—relax!

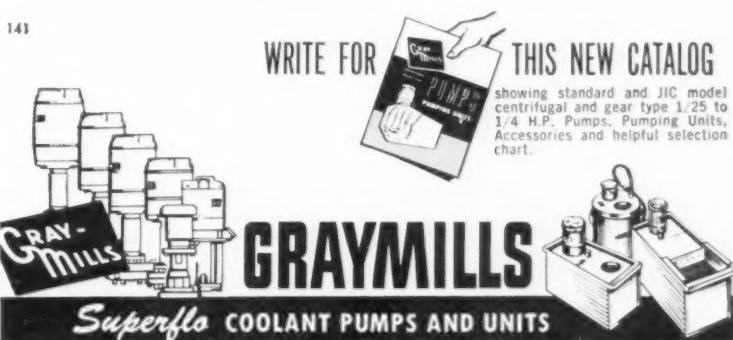
Graymills Corporation, 3761 N. Lincoln Ave., Chicago 13, Ill.

141

**WRITE FOR THIS NEW CATALOG**

showing standard and JIC model centrifugal and gear type 1/25 to 1/4 H.P. Pumps, Pumping Units, Accessories and helpful selection chart.

**GRAYMILLS**  
Superflo COOLANT PUMPS AND UNITS



Blanchard Machine Co., 64 State St., Cambridge, Mass.  
 Gardner Machine Co., Beloit, Wis.  
 Heald Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Mattison Machine Works, Rockford, Ill.  
 National Acme Co., 170 E. 131st St., Cleveland 8, Ohio  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio  
 Van Norman Mch. Co., Springfield, Mass.  
 Walker, O. S., Co., Inc., Worcester, Mass.

**GRINDING MACHINES, Thread**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
 Jones & Lamson Mch. Co., Springfield, Vt.

Landis Machine Co. (Centerless), Waynesboro, Pa.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

**GRINDING MACHINES, Universal**

Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Frauenthal Div., Muskegon, Mich.  
 Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.  
 Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.  
 Jones & Lamson Mch. Co., Springfield, Vt.  
 Landis Tool Co., Waynesboro, Pa.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.  
 Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

**GRINDING WHEEL DRESSING AND FORMING DEVICES**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoAll Co., Des Plaines, Ill.  
 Jones & Lamson Mch. Co., Springfield, Vt.  
 Metal Carbides Corp., Youngstown, Ohio  
 Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Sheffield Corp., Box 893, Dayton 1, Ohio

**GRINDING WHEELS**

Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.  
 Blanchard Machine Co., 64 State St., Cambridge, Mass.  
 Cincinnati Milling and Grinding Mch., Inc., Cincinnati 9, Ohio  
 Cincinnati Milling Products Div., Cincinnati 9, Ohio  
 Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.  
 Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
 DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
 Gardner Machine Co., Beloit, Wis.  
 Metal Carbides Corp., Youngstown, Ohio  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.  
 Sterling Grinding Wheel Co., Tiffin, Ohio

**GROOVING TOOLS, Internal**

Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.  
 Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**HAMMERS, Drop**—See Forging Hammers**HAMMERS, Portable Electric**

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
 Thor Power Tool Co., Aurora, Ill.

**HAMMERS, Portable Pneumatic**

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.  
 Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
 Thor Power Tool Co., 175 N. State St., Aurora, Ill.

**HAMMERS, Power**

Chambersburg Engrg. Co., Chambersburg, Pa.  
 Edlund Mchry. Co. Div., Cortland, N. Y.  
 Erie Foundry Co., Erie, Pa.  
 Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

**HARDENING FURNACES**

General Electric Co., Schenectady, N. Y.

**HARDNESS TESTERS**

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.  
 Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

**HEAT-TREATING EQUIPMENT**—See Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment**HOBBS**

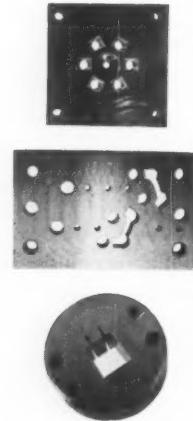
Barber-Colman Co., Rock and Montague, Rockford, Ill.

**PRECISION BUILT IN SWITZERLAND WITH WATCH-MAKING ACCURACY**

*Introducing The New*

**ELECTRO-SPARK**  
Electrical Erosion Machine

A revolutionary new method  
of die making and grinding  
of tool steel and carbides  
by the electric arc process



An additional new skilled  
tool maker in your shop at no  
extra cost

Inquiries invited for regional distributorships by well established representatives.



**ELECTRO-SPARK Co., Inc.**  
23 East 26th Street  
New York 10, N. Y.

Goddard & Goddard Co., Detroit, Mich.  
Michigan Tool Co., 7171 E. McNichols Rd.,  
Detroit 12, Mich.  
National Twist Drill & Tool Co., Rochester,  
Mich.  
Russell, Holbrook & Henderson, Inc., 292 Madison  
Ave., New York 17, N.Y.  
Star Cutter Co., 34500 Grand River, Farmington,  
Mich.

**HOISTS, Air**

Chicago Pneumatic Tool Co., 6 E. 44th St.,  
New York, N.Y.  
Ingersoll-Rand Co., 11 Broadway, New York  
4, N.Y.  
Thor Power Tool Co., Aurora, Illinois

**HOISTS, Electric**

Ingersoll-Rand Co., 11 Broadway, New York  
4, N.Y.

**HONING MACHINES**

Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Fulmer, C. Allen Co., 1231 First National  
Bank Bldg., Cincinnati 2, Ohio  
Jes-Cal Co., Fraser, Mich.  
Micromatic Hone Corp., 8100 Schoolcraft,  
Detroit 4, Mich.  
Moline Tool Co., 102-20th St., Moline, Ill.  
Sunnen Products Co., 7900 Manchester Ave.,  
St. Louis 17, Mo.  
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

**HONING STONES**

Barnes Drill Co., 814 Chestnut St., Rockford,  
Ill.  
Jes-Cal Co., Fraser, Mich.  
Norton Co., 1 New Bond St., Worcester 6,  
Mass.  
Sunnen Products Co., 7900 Manchester Ave.,  
St. Louis 17, Mo.

**HOSE**

American Metal Hose Br., American Brass Co.,  
23 Broadway, New York, N.Y.  
Schrader's Son, A. G., 470 Vanderbilt Ave.,  
Brooklyn 38, N.Y.

**HYDRAULIC MACHINERY**

**Tools and equipment**

Baldwin-Lima-Hamilton Corp., Eddystone Div.,  
Philadelphia 42, Pa.  
Barnes Drill Co., 814 Chestnut St., Rockford,  
Ill.  
Bethlehem Steel Corp., Bethlehem, Pa.  
Birdsboro Steel Fdry. & Mch. Co., Birdsboro,  
Pa.  
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton,  
Ohio  
Chambersburg Engng. Co., Chambersburg, Pa.  
Colonial Broach & Machine Co., P.O. Box 37,  
Harper Sta., Detroit 13, Mich.  
Cross Co., 3250 Belleview Ave., Detroit 7, Mich.  
Denison Engrg. Co., 1160 Dublin St., Columbus  
16, Ohio  
Erie Foundry Co., Erie, Pa.  
Farquhar, A. B., Div. Oliver Corp., York, Pa.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engrg. Corp., Kenmore Station, Buffalo,  
N.Y.  
Michigan Drill Head Co., Detroit 34, Mich.  
Modern Ind. Engrg. Co., 14230 Birwood Ave.,  
Detroit 4, Mich.  
Match & Merryweather Machinery Co., Penton  
Bldg., Cleveland, Ohio  
Oilgear Co., 1569 W. Pierce St., Milwaukee,  
Wis.  
Rockford Mch. Tool Co., 2500 Kishwaukee St.,  
Rockford, Ill.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette,  
Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rock-  
ford, Ill.  
Verson Allsteel Press Co., 93rd St. & S. Ken-  
wood Ave., Chicago, Ill.  
Vickers Incorporated, Div. of Sperry Rand  
Corp., 1402 Oakman Blvd., Detroit, Mich.  
Wilson, K. R., Inc., 211 Mill St., Arcade, N.Y.

**HYDRAULIC POWER UNITS OR  
TOOL HEADS**

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.  
Barnes, W. F. & John Co., 201 S. Waterford  
St., Rockford 11.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit  
32, Mich.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,  
Ill.  
Hartford Special Machinery Co., 287 Home-  
stead Ave., Hartford 12, Conn.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Michigan Drill Head Co., Detroit 34, Mich.  
Oilgear Co., 1569 W. Pierce St., Milwaukee,  
Wis.  
Rivett Lathe & Grinder, Inc., Brighton, Boston  
35, Mass.  
Vickers Incorporated, Div. of Sperry Rand Cor-  
poration, 1402 Oakman Blvd., Detroit, Mich.

**INDEXING and SPACING EQUIPMENT**

Austin Industrial Corp., White Plains, N.Y.  
Brown & Sharpe Mfg. Co., Providence, R.I.  
Eisler Engrg. Co., Inc., 750 South 13th St.,  
Newark, N.J.

Ettco Tool Co., Inc., 594 Johnson Ave., Brook-  
lyn 37, N.Y.  
Hardinge Bros., Inc., 1420 College Ave., El-  
mira, N.Y.  
Kearney & Trecker Corp., 6784 W. National,  
Milwaukee 14, Wis.  
Michigan Drill Head Co., Detroit 34, Mich.  
Morris, Robert E. Co., 76 Mamaroneck Ave.,  
White Plains, N.Y.  
Opto-Metric Tools, Inc., 137 Varick St., New  
York, N.Y.  
Sundstrand Mch. Tool Co., 2531 11th St., Rock-  
ford, Ill.  
Van Norman Mch., 3640 Main St., Spring-  
field 7, Mass.  
Wadell Equip. Co., Clark, N.J.  
Western Machine Tool Works, Holland, Mich.

**INDICATOR BASES, Magnetic**

Brown & Sharpe Mfg. Co., 235 Promenade St.,  
Providence 1, R.I.  
DoAll Co., Des Plaines, Ill.  
duMont Corp., 289 Wells St., Greenfield, Mass.  
Starrett L. S. Co., Athol, Mass.

Recent changes and addi-  
tions provide many bonus  
features.

Unobstructed perimeter  
(work from any side!)

Six  
Wheel  
Models



Capacities to 5,000 pounds. ®

# PORTELVATOR

The Handy HAMILTON Portable, Elevating Table

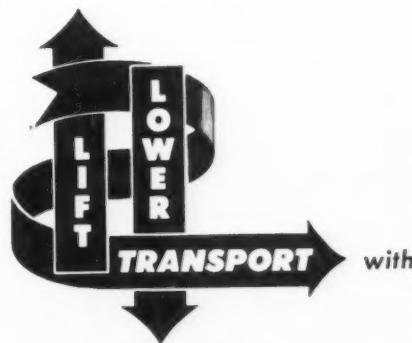
3 table surfaces  
4 point support

Four  
Wheel  
Models



Special  
Designs  
Tool

More Service  
for Less Money than  
Any other unit of equipment



A portable, height adjustable, steel  
table-truck-work bench! Used for die  
transfer, machine feeding, assembly  
(at best height, in best light). For lifting,  
lowering, transporting of all compact,  
heavy loads. Saves "handling" accidents  
to both men and materials.  
Saves minutes for men wherever used.

Write\*  
for NEW, FREE Bulletin  
No. P-2408

\* ADDRESS



2408

THE HAMILTON TOOL COMPANY  
834 South Ninth Street  
HAMONTON, OHIO

**INDICATOR LIGHTS**—See Lights, Indicator

**INDICATORS, Dial**

Ames B. C., Waltham 54, Mass.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Federal Products Corp., P. O. Box 1027, Providence, R. I.  
National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.  
Standard Gage Co., Inc., Poughkeepsie, N. Y.  
Starrett, The L. S. Co., Athol, Mass.

**INDICATORS, Speed**

Brown & Sharpe Mfg. Co., Providence, R. I.  
General Electric Co., Schenectady, N. Y.  
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio  
Starrett, The L. S. Co., Athol, Mass.

**INDICATORS, Test**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Federal Products Corp., P. O. Box 1027, Providence, R. I.  
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.  
Starrett, The L. S. Co., Athol, Mass.

**INDUCTION HEATING EQUIPMENT**

Cincinnati Milling & Grinding Mch., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
General Electric Co., Schenectady, N. Y.  
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

**INTENSIFIERS, Hydraulic**

Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Logansport Mch. Co., Inc., Logansport, Ind.  
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

**JACKS, Planer**—See Set-up Equipment

**JIG BORERS**

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.  
Cose Corp., 405 Lexington Ave., New York 17, N. Y.  
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio  
Homestrand, Inc., Larchmont, N. Y.  
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**JIGS AND FIXTURES**

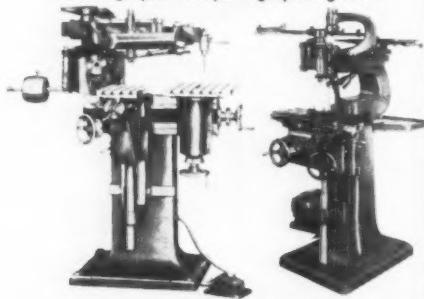
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio  
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio  
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.  
Metal Carbides Corp., Youngstown 12, Ohio  
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.  
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

## OUTSTANDING NEW MACHINERY AT LOWER COST!

### \$1. BUYS ANY MACHINE

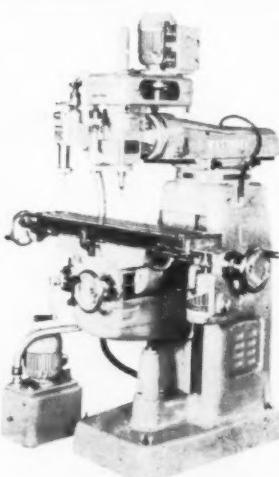
Upon termination of 3 year rental plan

**PEAR high precision pantograph engravers**



PF/2 3 dimensional  
**\$2,695.**

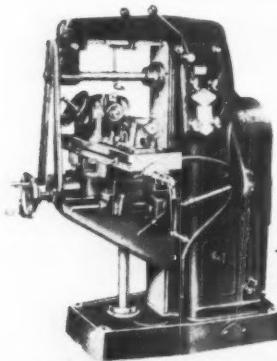
CG/3 2 dimensional  
**\$1,495.**



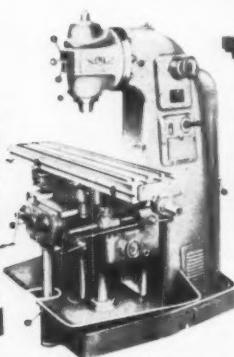
**CONTOUR MILLER**  
with hydraulic high speed vertical  
duplicating head.

**\$3,190**

### PEDERSEN MILLING MACHINES



**VPU-O \$2,595.**



**VPV-2 \$6,590.**



**PEDERSEN UNIVERSAL TOOL &  
CUTTER GRINDER, MODEL U.S.I.**  
Main spindle rated at 3,800 to 5,750  
RPM. 36 $\frac{1}{2}$ " x 5 $\frac{1}{2}$ " table working  
surface. **\$2,595**

### AARON MACHINERY CO., INC.

DEPT. Y, 45 CROSBY ST., N. Y. 12

Branches at: Buffalo, N. Y. - Mineola, N. Y. - Los Angeles, Calif.

WA 5-8300

LIBERAL  
TERMS

**LATHE ATTACHMENTS**

Atlas Press Co., Kalamazoo, Mich.  
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Hardinge Bros., Inc., 1420 College Ave., Elmhurst, N. Y.  
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.  
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**LATHES, AUTOMATIC**—See Chucking Machines

**LATHES, Axle**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.  
Monarch Mch. Tool Co., Oak St., Sidney, Ohio  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**LATHES, Bench**

Atlas Press Co., Kalamazoo, Mich.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Hardinge Bros., Inc., 1420 College Ave., Elmhira, N. Y.  
Homestrand, Inc., Larchmont, N. Y.  
LeBlond R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
Levin, Louis & Son, Los Angeles 21, Calif.  
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

**LATHES, Car Wheel**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Bullard Co., Bridgeport 6, Conn.  
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

**LATHES, Crankshaft**

Consolidated Mch. Tool Corp., Rochester, N. Y.  
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Double-End**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Consolidated Mch. Tool Corp., Rochester, N. Y.  
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

**LATHES, Duplicating**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio  
Sidney Machine Tool Co., Sidney, Ohio  
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

**LATHES, Engine, Manufacturing**

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio  
Atlas Press Co., Kalamazoo, Mich.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.  
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio  
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Eustachio, S., Brescia, Italy.  
Homestrand, Inc., Larchmont, N. Y.  
Hydro-Feed Mch. Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.  
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio  
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
Sidney Machine Tool Co., Sidney, Ohio  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Springfield Mch. Tool Co., Springfield, Ohio  
Western Machine Tool Works, Holland, Mich.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Hardinge Bros. Inc., 1420 College Ave., Elmhira, N. Y.  
Homestrand, Inc., Larchmont, N. Y.  
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio  
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
Sidney Machine Tool Co., Sidney, Ohio  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Springfield Mch. Tool Co., Springfield, Ohio  
Western Machine Tool Works, Holland, Mich.  
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

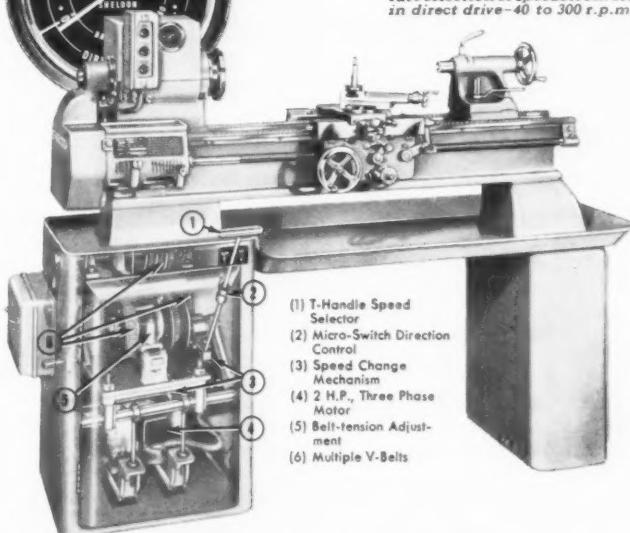
**LATHES, Engine, Toolroom**

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio  
Atlas Press Co., Kalamazoo, Mich.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.

# SHELDON Variable Speed PRECISION LATHES

...any speed INSTANTLY\*

\* Spindle speeds changed at 100 r.p.m. per second. Built-in tachometer permits accurate selection of speeds from 200 to 1800 r.p.m. in direct drive—40 to 300 r.p.m. in back gear.



This new lathe instantly meets every changing speed requirement in the tool room, or quickly sets and holds to any prescribed speed for production runs.

**Rugged, Heavy-duty Variable Speed Drive** —an oversized unit with double V-belts throughout that delivers positive full-power to the spindle.

**High Spindle Speeds**—from 200 r.p.m. to 1800 r.p.m. (direct drive), from 40 r.p.m. to 300 r.p.m. in back gear.

**Instant and Automatic (power driven) Speed Selection**—Only 9 seconds to change from low to high speeds in either direct drive or backgear. Speeds are changed automatically when T-handle is lifted or pushed into engagement.

Write for Catalog

**SHELDON MACHINE CO. INC.**

**High Horsepower at All Speeds**—Because the drive unit is oversized, it has larger belts which deliver maximum gripping power at all speeds. A 2 H.P., three phase motor recommended.

Additional lathe features: Zero Precision tapered roller spindle bearings, 54 pitch gear box, heavy cast pedestal, tool-room accuracy. Optional accessories include hardened bed ways, L-60 long taper key drive or 4° D1 Camlock spindles.

Sheldon Precision Variable Speed Lathes are available in 11" or 13" Swing. Model WM-56-P (Illustrated) less motor and switch, \$1,944.00 F.O.B. Chicago. Other 10", 11", and 13" Sheldon Precision Lathes from \$832.00 up. Also 13" and 15" Sebastian Geared Head Lathes, Sheldon Milling Machines and Sheldon Shapers.

4246 N. KNOX AVE. • CHICAGO 41, ILL.

## Product Directory

### **LATHES, Gap**

Atlas Press Co., Kalamazoo, Mich.  
 Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
 Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Homestrain, Inc., Larchmont, N. Y.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
 Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
 Sidney Machine Tool Co., Sidney, Ohio  
 Springfield Mch. Tool Co., Springfield, Ohio

### **LATHES, Hollow Spindle**

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
 South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

### **LATHES, Roll**

American Tool Works Co., Cincinnati 2, Ohio  
 Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
 Bliss, E. W., Co., Canton, Ohio  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
 Monarch Mch. Tool Co., Oak St., Sidney, Ohio

### **LATHES, Speed, Second-operation**

Atlas Press Co., Kalamazoo, Mich.  
 Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.  
 LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio  
 Lodge & Shipley Co., Cincinnati 25, Ohio  
 Monarch Mch. Tool Co., Oak St., Sidney, Ohio  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.  
 Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

### **LATHES, Spinning**

Cincinnati Milling & Grinding Mch., Inc., 4701 Marburg Ave., Cincinnati 19, Ohio  
 Lodge & Shipley Co., The, Cincinnati 25, Ohio

**LATHES, Toolroom**—See Lathes, Engine, Toolroom

### **LATHES, Turret, Automatic**

Atlas Press Co., Kalamazoo, Mich.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Bullard Co., Brewster St., Bridgewater 2, Conn.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.  
 Nat'l Acme Co., 170 E. 131st St., Cleveland 3, Ohio  
 New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

### **LATHES, Turret, Ram Type, Saddle Type**

Atlas Press Co., Kalamazoo, Mich.  
 Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio  
 Bullard Co., Brewster St., Bridgeport 2, Conn.  
 Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
 Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
 Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.  
 Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.  
 Levin & Son, Inc., Louis, Los Angeles 8, Calif.  
 New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.  
 Seneca Falls Mch. Co., Seneca Falls, N. Y.  
 Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.  
 South Bend Lathe Wks., South Bend 22, Ind.  
 Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

**LATHES, Turret Vertical**—See Boring Mills, Vertical

### **LAYOUT and DRAFTING TOOLS**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
 Starrett, L. S., Co., Athol, Mass.

### **LEVELS**

South Bend Lathe Wks., South Bend 22, Ind.  
 Starrett, The L. S., Co., Athol, Mass.

### **LIGHTING FIXTURES, Machine**

Sun-Lite Mfg. Co., 2555 Bellevue Ave., Detroit 7, Mich.

### **LIGHTS, Indicator**

Daylight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.  
 General Electric Co., Schenectady, N. Y.

**LIMIT SWITCHES**—See Switches, Limit

**Arter "Jigmatic" will do ALL your positioning . . . and do it fast**

**Check These Features...**

- No stops
- No gauge rods
- Only SECONDS to change tapes
- MINUTES to set up
- No more than 11 tape holes to punch per position
- 600,000,000 possible positions. Hundreds of positions per single set-up
- Automatic magnetic locking
- Accuracy — plus or minus .001"
- Unidirectional approach at minimum speed
- Simultaneous operation of both coordinates

**The 20"x30" ARTER has them all**

### **ARTER GRINDING MACHINE COMPANY**

WORCESTER 5, MASSACHUSETTS

Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders  
 Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders  
 AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

**LUBRICATING OILS and GREASES**

Cities Service Oil Co., 70 Pine St., New York, N. Y.  
 Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.  
 Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.  
 Shell Oil Co., 50 W. 50th St., New York, N. Y.  
 Standard Oil Co. (Indiana) 910 S. Michigan, Chicago, Ill.  
 Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.  
 Texas Co., 135 E. 42nd St., New York, N. Y.

**LUBRICATING SYSTEMS**

Farval Corp., 3249 E. 80th St., Cleveland, Ohio  
 Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.  
 Madison-Kipp Corp., Madison, Wis.

**MACHINERY, Used and Rebuilt**

Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio  
 Michigan Drill Head Co., Van Dyke, Mich.  
 Miles Mchry. Co., 2025 E. Genesee Ave., Saginaw, Mich.  
 Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio  
 Van Keuren Co., Watertown 72, Mass.  
 Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

**MACHINISTS' SMALL TOOLS**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
 Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.  
 Starrett, L. S., Co., Athol, Mass.

**MANDRELS**—See Arbors and Mandrels

**MARKING MACHINES and DEVICES**

Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.  
 Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.  
 Gorton Mch. Co., 1321 Racine St., Racine, Wis.

**MATERIAL-HANDLING TRUCKS**—See Trucks, Material Handling

**MEASURING MACHINES**

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio  
 Van Keuren Co., Watertown 72, Mass.

**MEASURING WIRES, Thread, Spline, Gear**

Sheffield Corp., Dayton 1, Ohio  
 Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.  
 Van Keuren Co., Watertown 72, Mass.

**MICROMETER HEADS**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
 DoAll Co., Des Plaines, Ill.  
 Starrett, The L. S., Co., Athol, Mass.

**MICROMETERS, Outside, Inside, Depth**

Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
 Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Starrett, The L. S. Co., Athol, Mass.  
 Van Keuren Co., Watertown 72, Mass.

**MICROSCOPES, Toolmakers'**

DoAll Co., Des Plaines, Ill.  
 Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.  
 Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

**MILLING MACHINE ATTACHMENTS**

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
 G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
 Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.  
 Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio  
 Hardinge Bros., Inc., 1420 College Ave., Elmhira, N. Y.  
 Homesfrand, Inc., Larchmont, N. Y.  
 Kearney & Trecker Corp., Milwaukee, Wis.  
 Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.  
 Van Norman Co., 3640 Main St., Springfield 7, Mass.

**MILLING MACHINES, Automatic**

Cincinnati Milling Machine Co., Cincinnati, Ohio

Consolidated Machine Tool Corp., Rochester, N. Y.  
 Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
 Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
 Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.  
 Kearney & Trecker Corp., Milwaukee, Wis.  
 Macroc Machinery Corp., Yonkers, N. Y.  
 Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
 Motch & Merryweather Machinery Co., Perron Bldg., Cleveland, Ohio  
 Pratt & Whitney Co., Inc., West Hartford, Conn.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
 Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.  
 U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(Continued on page 302)

**Star performers**

**COAST-TO-COAST**  
**Time SAVING!**  
**Wheel SAVING!**  
**Tool SAVING!**

**STRANDARD CARBIDE TOOL GRINDERS**

**STRANDARD** builds a carbide tool grinder for every job "in the book" ... grinders time-tested by industry for 4 decades! Ask for Literature

**the**  
**STRANDARD** Since 1912  
**electrical tool co.**  
 GRINDERS AND MACHINE TOOLS  
 2500 RIVER ROAD  
 CINCINNATI 4 • OHIO

Type 14 TD Wet or Dry Twin Wheel Carbide Tool Grinder 6"-10" & 14" Wheels

Type 10 T Wet or Dry Single Wheel Tool Grinder 6"-10" & 14" Wheels

Type 67 Vari-Tool Finisher 6" Wheel With Abrasive Belt

HALLMARK OF **S** METALWORKING THROUGHOUT THE WORLD

**MILLING MACHINES, Bench, Hand**

Atlas Press Co., Kalamazoo, Mich.  
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.  
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.

**MILLING MACHINES, Bed Type, Simplex, Duplex**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.  
Espec-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.  
Match & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio  
Sundstrand Mch. Tool Co., 2531 11th St., U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.  
Van Norman Co., 3640 Main St., Springfield 7, Mass.

**MILLING MACHINES, Circular, Continuous**

Consolidated Mch. Tool Corp., Rochester, N. Y.  
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.  
Espec-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**MILLING MACHINES, Die Sinking, Duplicating, Profiling**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.  
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.  
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
Van Norman Co., 3640 Main St., Springfield 7, Mass.

**MILLING MACHINES, Knee Type Rise and Fall**

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Homestrand, Inc., Larchmont, N. Y.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

**MILLING MACHINES, Knee Type Ram**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
Gorton Mch. Co., 1321 Racine St., Racine, Wis.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Van Norman Co., 3640 Main St., Springfield 7, Mass.

**MILLING MACHINES, Knee Type, Turret**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

**MILLING MACHINES, Knee Type, Vertical**

Atlas Press Co., Kalamazoo, Mich.  
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.  
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.  
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio  
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.  
Homestrand, Inc., Larchmont, N. Y.  
Kearney & Trecker Corp., Milwaukee, Wis.

**MILLING MACHINES, Planer Type**

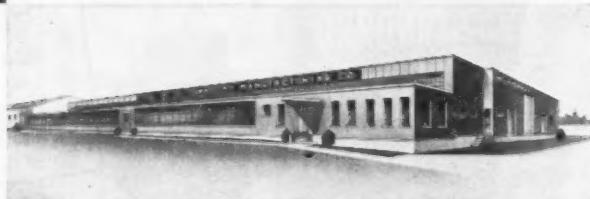
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Espec-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.  
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio  
Kearney & Trecker Corp., Milwaukee, Wis.  
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

**MILLING MACHINES, Spar**

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
Kearney & Trecker Corp., Milwaukee, Wis.  
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

**MILLING MACHINES, Thread**

Coulter Mch. Co., James, Bridgeport 5, Conn.  
Lees-Bradner Co., The, Cleveland 11, Ohio  
(Continued on page 304)

**TOWNSEND of Hartford**

## Big new factory to meet world demand for **TOWNSEND Qualimatic MACHINES**

The demand for Townsend machinery has quadrupled during the last few years. In order to bring under one roof the engineering, manufacturing, shipping and main offices for all 4 Townsend lines we have built this spacious, modern building. When in Hartford please come and see us.

THE H. P. TOWNSEND  
MANUFACTURING CO.

- High-Speed Shavers
- Riveters
- Automatic Screw Machines
- Special Machines

TAYLOR and FENN  
(Machine Division)

- Duplex Spline Millers
- Spring Presses
- Drilling Machines

CLEVELAND TAPPING  
MACHINE CO.

- Drilling and Tapping Machines
- Fitting Machines
- Indexing Tables
- Metal Sawing Machines

COCHRANE BLY

**The H. P. TOWNSEND MANUFACTURING CO.**  
HARTFORD 10, CONNECTICUT

**Now...**

**KENDEX\***

**boring**

---

**bars**

**bring all the advantages  
of the Kendex principle  
to turret lathe boring operations**

Exhaustive tests on different turret lathes\*\* prove that Kendex Boring Bars provide all the benefits and economies of the Kendex principle now enjoyed in turning, facing, and milling operations. In addition, and probably more important in boring operations, Kendex Boring Bars provide the following advantages over other types of bars:

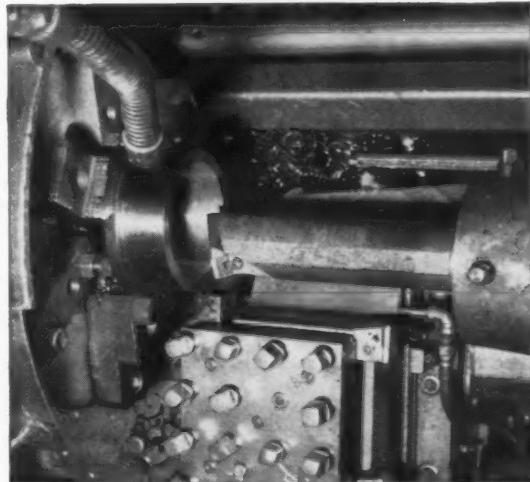
- the cutting point is brought down to the center line of the bar
- greater support of the cutting edge is provided
- better chip control (uses standard Kendex chipbreaker plate)
- boring operations performed better at higher speeds made possible with Kendex bar
- permits use of thin insert—greater resistance to thermal shock
- throw-away insert permits use of harder grades—greater resistance to edge wear at higher speeds
- cutting inserts index accurately (saves time on size adjustment)—less downtime

Kendex Boring Bars, with the right grade of "throw-away" Kennametal\* insert, can be used for both rough and finish boring of pieces up to several inches in diameter. The bar with 15-degree lead angle and square insert together with the bar for turning to a square shoulder with a triangular insert will take care of practically all boring operations—thus eliminating the need for a variety of styles.

Why not call your Kennametal tool engineer to demonstrate these new Kendex bars? He will also help you select the right grade of Kennametal insert for each boring operation. Or write for additional information, KENNAMETAL INC., Latrobe, Pennsylvania.

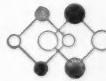
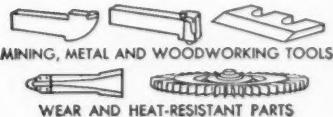
\*Trademarks

\*\*Tests made on Warner-Swasey, Jones & Lamson, Gibolt and other turret lathes



Kendex Boring Bars for Turret Lathes with Kennametal "throw-away" inserts . . . eliminate costly grinding . . . index accurately without re-setting tool . . . reduce machine downtime . . . slash cost per cutting edge . . . resist thermal shock . . . permit boring to close tolerances . . . better chip control (chipbreaker not shown in illustration at top of page)

C-3003



INDUSTRY AND  
**KENNAMETAL**  
...Partners in Progress



For more information fill in page number on Inquiry Card, on page 233

MACHINERY, January, 1957—303

# WHY MONARCH lathe head stocks are MICROHONED

Monarch Machine Tool Company Microhones the spindle bores in its lathe head stocks because Microhoning . . . generates consistent finish, size, and alignment of bores . . . corrects out-of-roundness . . . eliminates cost of line-reaming operations . . . permits interchangeability of spindles and bearings.



And with the use of a new three-diameter Microhoning tool, honing time is reduced approximately 40% over former method which employed two double-diameter tools. One set-up now replaces multiple set-ups previously required.

#### APPLICATION DATA:

**STOCK REMOVAL**  
.003" to .004"

**TOLERANCES**

diameter..... .0002"  
roundness..... .0001"  
taper..... .0001"

**FINISH....20-25 microinches**

**PREVIOUS OPERATION**  
line boring

**3 IN-LINE BORE SIZES**

4.125" dia. x 1.500" long  
5.118" dia. x 1.250" long  
6.299" dia. x 5.125" long

Micromatic tooling for Microhoning applications is constantly furnishing manufacturers with cost reductions, higher production and better functional characteristics. A Micromatic Field Engineer will be glad to discuss your production problems and show you "Why" the proper Microhoning tools will help.

*The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.*

- Please send me "Progress in Precision" in time for showing on \_\_\_\_\_ (date).
- Please have a Micromatic Field Engineer call.
- Please send Microhoning literature and case histories.

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_

ZONE \_\_\_\_\_ STATE \_\_\_\_\_ C



## MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

#### MOLDING MACHINES, Plastic

Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio  
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.

#### MOLYBDENUM

Climax Molybdenum Co., New York, N. Y.

#### MOTORS, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
General Electric Co., Schenectady, N. Y.  
Howell Electric Motors Co., Howell, Mich.  
Lincoln Electric Co., Cleveland 17, Ohio  
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

#### MOTORS, Hydraulic

Barnes, J. S. Corp., Rockford, Ill.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio  
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.  
Vickers, Inc., Detroit 32, Mich.

**MULTIPLE INSPECTION GAGES**—See  
Gages, Multiple Inspection

#### MULTIPLE-STATION MACHINES, Dial Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.  
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio  
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.  
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.  
Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Ettor Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.  
Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.  
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.  
Michigan Drill Head Co., Van Dyke, Mich.  
Millholland, W. K. Mchry. Co., Inc., Indianapolis 20, Ind.  
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.  
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.  
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

#### MULTIPLE-STATION MACHINES, Transfer Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.  
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio  
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.  
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.  
Bullard Co., Bridgeport 6, Conn.  
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio  
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.  
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Greenfield Bros. & Co., 2136 - 12th St., Rockford, Ill.

Head Machine Co., 10 New Bond St., Worcester 6, Mass.  
 Kearney & Trecker Corp., Milwaukee, Wis.  
 La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.  
 Michigan Drill Head Co., Van Dyke, Mich.  
 Millholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.  
 Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.  
 Moline Tool Co., 102-20th St., Moline, Ill.  
 National Automatic Tool Co., 5, 7th N. Sts., Richmond, Ind.  
 Norton Co., 1 New Bond St., Worcester 6, Mass.  
 Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.  
 Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.  
 Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

**NAMEPLATES**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

**NIBBLING MACHINES**

Thor Power Tool Co., 175 N. State St., Aurora, Ill.  
 Wales-Stripet Corp., North Tonawanda, N. Y.

**NICKEL AND NICKEL ALLOYS**

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

**NUMBERING MACHINES**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

**NUT SETTERS**—See Screwdrivers, etc.

**NUTS**—See Bolt, Nuts and Screws

**OIL EXTRACTORS**

De Laval Separator Co., Poughkeepsie, N. Y.

**OIL GROOVERS**

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

**OILERS AND LUBRICATORS**

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.  
 Madison-Kipp Corp., Madison, Wis.  
 Wicaco Mch. Corp., Philadelphia, Pa.

**OILS, CUTTING SOLUBLE**—See Cutting and Grinding Fluids

**OILS, Lubricating**—See Lubricating Oils and Greases

**OILS, Quenching and Tempering**

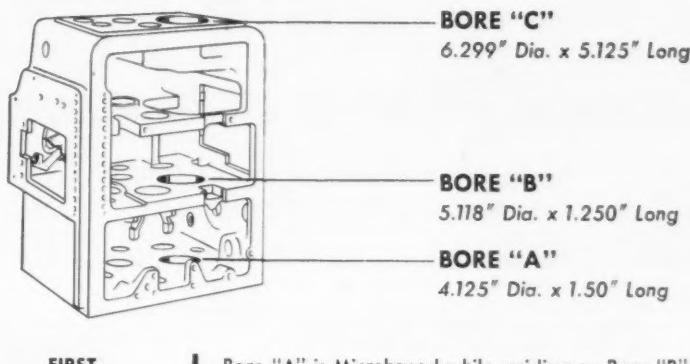
Cities Service Oil Co., 70 Pine St., New York, N. Y.  
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.  
 Shell Oil Co., 50 W. 50th St., New York, N. Y.  
 Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.  
 Standard Oil Co., (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.  
 Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

**OPTICAL FLATS**

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.  
 DoAll Co., Des Plaines, Ill.  
 Scher, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.  
 Van Keuren Co., Watertown 72, Mass.  
*(Continued on page 306)*

# HOW with one set-up MONARCH MICROHONES three bore diameters

Using a three-diameter tool and only one set-up, Monarch Machine Tool Company Microphones three in-line bores in lathe head stocks. Bore diameters are 4.125", 5.118" and 6.299". Stroke of Microhoning tool is changed only once during the working of all three bores. Former method of honing required multiple tooling and set-up.

**How Monarch Microphones:****BORE "C"**

6.299" Dia. x 5.125" Long

**BORE "B"**

5.118" Dia. x 1.250" Long

**BORE "A"**

4.125" Dia. x 1.50" Long

FIRST  
STROKE SETTING

Bore "A" is Microhoned while guiding on Bore "B"  
 Bore "B" is Microhoned while guiding on Bore "A"

SECOND  
STROKE SETTING

Bore "C" is Microhoned while guiding on Bore "B"

**How This Microhone Tool Operates:**

A compound cone in the tool allows any one of the three bores to be Microhoned by expanding or collapsing individual banks of stones and guides. A selector sleeve shifts the cone rod to provide positive control of abrasives and guides. Micromatic "How" knowledge, obtained through 27 years of experience in designing, engineering and manufacturing of Microhoning equipment for all types of applications throughout the world, can solve your production honing problems.

Learn how Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

- Please have a Micromatic Field Engineer call.  
 Please send Micromatic literature and case histories.

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_ C



## MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

## Product Directory

**PACKING, Leather, Metal, Rubber, Asbestos, Etc.**  
 Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.  
 Garlock Packing Co., Palmyra, N. Y.  
 Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

**PAINTING EQUIPMENT, Spray**—See Spraying Equipment, Metal

### PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.  
 DoAll Co., Des Plaines, Ill.  
 Starrett, The L. S. Co., Athol, Mass.  
 Walker, O. S., Co., Inc., Worcester, Mass.

### PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.  
**PIPE, Steel, Stainless, etc.**  
 Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Carpenter Steel Co., 105 W. Bern St., Reading, Pa.  
 Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.  
 Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.  
 United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

**PIPE AND TUBING MILLS, Electric-weld**  
 Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

### PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.  
 Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.  
 Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

### PIPE THREADING AND CUTTING MACHINES

Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.  
 Landis Machine Co., Inc., Waynesboro, Pa.  
 Sheffield Corp., Dayton 1, Ohio

**PLANER JACKS**—See Set-up Equipment

### PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
 Consolidated Mch. Tool Div., Rochester, N. Y.  
 Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
 Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio  
 Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

### PLASTICS AND PLASTIC PRODUCTS

Dow Chemical Co., Midland, Mich.  
 Eastman Kodak Co., 343 State St., Rochester 4, N. Y.  
 Garlock Packing Co., Palmyra, N. Y.  
 Gisholt Mch. Co., Madison, Wis.  
 U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

**PRESS BRAKES**—See Brakes, Presses and Bending

### PRESS FEEDERS, Automatic

Bliss Co., E. W., Canton, Ohio  
 Federal Press Co., 511 Division St., Elkhart, Ind.  
 Nilson, A. H. Machine Co., Bridgeport, Conn.  
 Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.  
 U. S. Tool Co., East Orange, N. J.

### PRESS STACKERS and STORAGE SHUTTLES

Michigan Production Eng. Co., Hazel Park, Mich.

### PRESSES, Arbor

Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.  
 Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
 du Mont Corp., Greenfield, Mass.  
 Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
 Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.  
 Logansport Machine Co., Inc., Logansport, Ind.  
 Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.  
 Wilson, K. R., Inc., Arcade, N. Y.

### PRESSES, Assembling

Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio  
 Colonial Broach & Machine Co., Box 37, Detroit 13, Mich.  
 Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.  
 Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
 Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
 Federal Press Co., 511 Division St., Elkhart, Ind.  
 Ferracute Machine Co., Bridgeton, N. J.  
 Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.

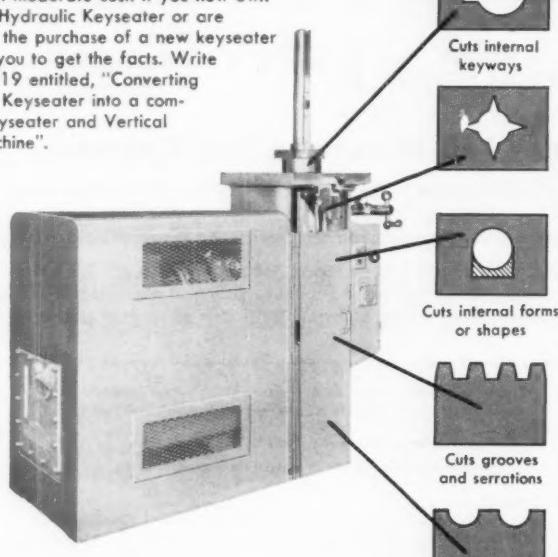
(Continued on page 308)

## TRIPLE THE USEFULNESS OF YOUR M&M

### KEYSEATER AND VERTICAL CUTTING MACHINE

Simple modification greatly increases productive capacity of this versatile machine.

An M & M Hydraulic Keyseater is not only a keyseater that cuts internal keyways up to 5" wide but a vertical cutting machine as well. Serrations, grooves, teeth—a wide variety of cuts can be rapidly made on this machine with only one simple modification—a work-holding table. This table is now available at moderate cost. If you now own an M & M Hydraulic Keyseater or are considering the purchase of a new keyseater it will pay you to get the facts. Write for Bulletin 19 entitled, "Converting the M & M Keyseater into a combination Keyseater and Vertical Cutting Machine".

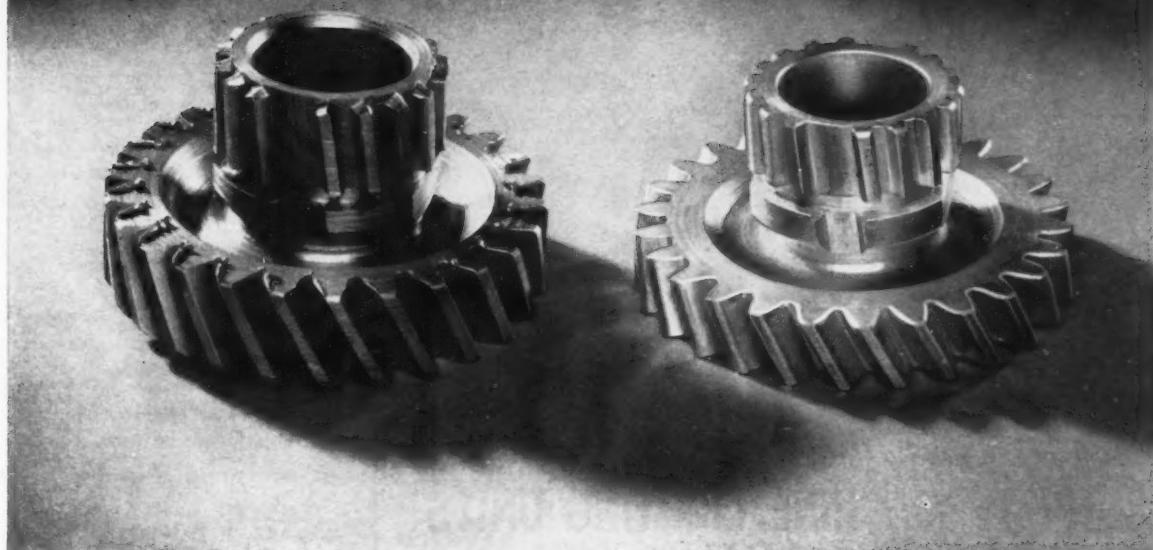


## M&M KEYSEATERS AND VERTICAL CUTTING MACHINES

MITTS & MERRILL • 64 Holden Street • SAGINAW, MICHIGAN

98

# 6 seconds ago they were the same



## ...then a *Burr-Master* went to work



New Burr-Master Duplex 2-station machine. Available in two size ranges, also single-station model. All with Modern's quick-change tooling. Deburs and chamfers gears from .625" to 6.5" p.d. and 3.0" to 9.5" p.d.

When gears have to be smooth and quiet in operation, complete deburring and chamfering is necessary. Burr-Masters cut away the burr and chamfer the edges and root of every tooth completely with a fast, accurate generated cutting action.

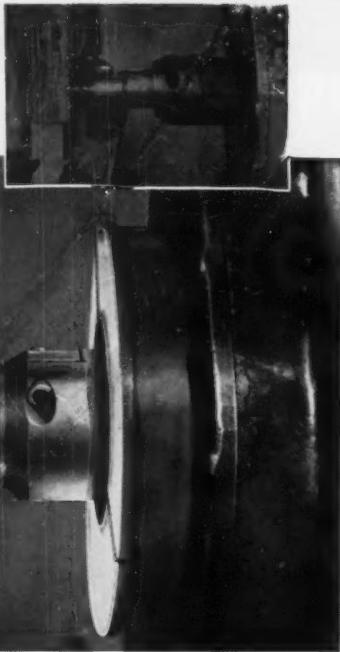
Burr-Master production rates average 5 teeth per second deburring and chamfering gears or splines, internal or external teeth, spur or helical tooth form. Time to completely finish the 26-tooth transmission gear above is less than 6 seconds.

Even faster production is possible with the new Burr-Master Duplexes, which finish both sides of the teeth at the same time—at the same rates.

Bulletin BM-1 should help you on all problems of deburring and chamfering gears or splines. Ask for it.

**MODERN**<sup>®</sup>  
Industrial Engineering Co.

**See the difference "Sun-Lite" makes**  
on this typical boring mill set-up! At right, under normal shop lighting conditions, tool and work are poorly defined, hard to see. Below, with Sun-Lite "Circline" Unit mounted over the spindle, the entire working area is bathed in soft, glare-free light.

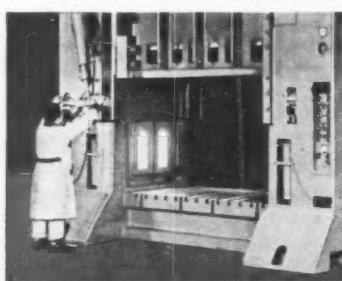


## Increase production, reduce scrap losses with **SUN-LITE MACHINE LIGHTING UNITS!**

It's a matter of record! People work better, produce more work when they can see what they're doing without straining their eyes. What's more, with new Sun-Lite machine lighting units on

the job, you'll also find they turn out higher quality work . . . consistently, and in greater safety, too.

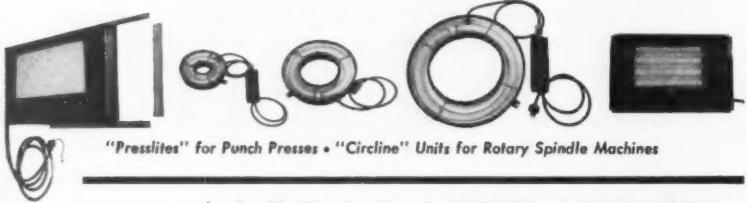
For you see, Sun-Lite machine lighting units are designed especially to provide proper illumination where it is needed most . . . on the critical surfaces in the working area. They are complete, self-contained units which can be quickly and easily mounted to your present production machinery. And each is equipped with a shatter-proof, oil-resistant Plexiglas louver specially processed for high light output, low surface brightness.



- Large forming press equipped with four Sun-Lite "Presslites." Machine-etched louvers prevent glare, assure maximum light transmission to die bed area, reducing danger of damaging costly dies and tools.

**Sun-Lite**  
MANUFACTURING COMPANY

2555 Bellevue Avenue • Detroit 7, Mich.



"Presslites" for Punch Presses • "Circline" Units for Rotary Spindle Machines

### Get the Facts!

Send coupon today for complete information on the entire line of Sun-Lite Machine Lighting Units.

**Sun-Lite Mfg. Co., Dept. A • 2555 Bellevue, Detroit 7, Michigan**  
Gentlemen: Please send me complete specifications and installation data on your Machine Lighting Units.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

### PRESSES, Blanking, Stamping

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Bath, Cyril Co., 32324 Solon Rd., Solon, Ohio  
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio  
Chambersburg Engineering Co., Chambersburg, Pa.  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Cleveland Crane & Engineering Co., Wickliffe, Ohio  
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
Daily Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
Federal Press Co., 511 Division St., Elkhart, Ind.  
Ferracute Machine Co., Bridgeton, N. J.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.  
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio  
Minster Machine Co., Minster, Ohio  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
U. S. Tool Co., Inc., 255 N. 18th St., East Orange, N. J.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wilson, K. R., Inc., Arcade, N. Y.

### PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Farquhar, A. B. Div., 142 Duke St., York, Pa.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Wilson, K. R., Inc., Arcade, N. Y.

### PRESSES, Closed-Die Forging

Ajan Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio  
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio  
Chambersburg Engineering Co., Chambersburg, Pa.  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wilson, K. R., Arcade, N. Y.

### PRESSES, Coining, Embossing

Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.  
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio  
Chambersburg Engineering Co., Chambersburg, Pa.  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
Daily Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
Ferracute Machine Co., Bridgeton, N. J.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.

Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
 Minster Machine Co., Minster, Ohio  
 Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
 Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
 Wilson, K. R., Arcade, N. Y.

**PRESSES, Die Sinking (Hobbing)**

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
 Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
 Chambersburg Engineering Co., Chambersburg, Pa.  
 Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
 Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
 Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
 Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
 Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
 Wilson, K. R., Inc., Arcade, N. Y.

**PRESSES, Die Tryout**

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
 Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
 Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
 Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
 Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
 Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
 Federal Press Co., 511 Division St., Elkhart, Ind.  
 Ferracutte Machine Co., Bridgeton, N. J.  
 Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
 Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.  
 L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.  
 Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
 Minster Machine Co., Minster, Ohio  
 Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
 Products Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.  
 Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
 Wilson, K. R., Inc., Arcade, N. Y.

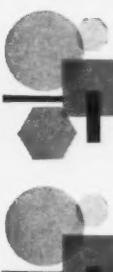
**PRESSES, Drawing**

Baird Machine Co., 1700 Stratford Ave., Stratford Conn.  
 Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
 Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
 Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio  
 Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
 Cleveland Crane & Engineering Co., Wickliffe, Ohio  
 Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
 Danly Machine Specialties, Inc., 2100 S. LaSalle, Chicago 50, Ill.  
 Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
 Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
 Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
 Ferracutte Machine Co., Bridgeton, N. J.  
 Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
 Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.  
 L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.  
 Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
 Minster Machine Co., Minster, Ohio  
 Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
 Nilson, A. H. Machine Co., Bridgeport, Conn.  
 Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
 Wilson, K. R., Inc., Arcade, N. Y.

(Continued on page 312)

**WHEELOCK, LOVEJOY & COMPANY, INC.**

**1250 Marquette Street, Cleveland Ohio**

**WHEELOCK, LOVEJOY & COMPANY, INC.**

**1855 So. Kilbourn Avenue, Chicago Illinois**

**WHEELOCK, LOVEJOY & COMPANY, INC.**

**265 Pennsylvania Avenue, Hillside New Jersey**

**WHEELOCK, LOVEJOY & COMPANY, INC.**

**12989 Greeley Avenue, Detroit Michigan**

**WAREHOUSES AT YOUR SERVICE**

You'll get quick action on your order for alloy steel bars, billets or forgings . . . no matter what size, shape or heat treatment you require . . . when you call any one of our seven warehouses.

All seven are conveniently located in principal industrial areas. Each is staffed by expert metallurgists, and is well-stocked to give you speedy service.

Fill your current needs by ordering our own HY-TEN steels, the "standard steels of tomorrow", or standard AISI or SAE grades.

Or write today to our Cambridge office for your free Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

*In Canada: Sanderson - Newbould, Ltd., Montreal and Toronto*

**WHEELOCK, LOVEJOY & COMPANY, INC.**

**144 Milton Street, Buffalo New York**

**WHEELOCK, LOVEJOY & COMPANY, INC.**

**4524 W. Mitchell Avenue, Cincinnati Ohio**

**HOME OFFICE:****WHEELOCK, LOVEJOY & COMPANY, INC.**

**138 Sidney Street, Cambridge 39 Massachusetts**



# Are Reliable Working Tools Them to Work Helping You!

## INGENIOUS MECHANISMS FOR DESIGNERS AND INVENTORS—

**Volumes I and II by Franklin D. Jones.**  
**Volume III by Holbrook L. Horton**

A comprehensive encyclopedia of mechanical movements unparalleled in scope and usefulness. Each volume is an independent treatise on the subject of mechanisms. The books are similar in size and general character, but the contents are different. You are told plainly and briefly what each mechanism consists of how it operates, and the features which make it of special interest. Hundreds of illustrations in each volume.

**Single Volume, \$6.50**  
**Complete Set, \$16.00**

In Canada or overseas, single volume, \$7.40; two volumes, \$14.20; three volumes, \$18.00.

## MANUAL OF GEAR DESIGN—

### Three Volumes—

by Earl Buckingham

The first volume of this three-volume library of gear data consists entirely of mathematical tables, especially applicable to gear design. Volume Two contains simple formulas and time-saving tables required in solving all kinds of spur and internal gear designing problems. Section Three contains formulas, charts and tables used in designing helical gears for parallel shaft drives and "spiral" gears for non-parallel, non-intersecting shafts.

**Complete Three-Volume Set, \$9.00**

**Any Single Volume, \$3.50**

In Canada or overseas, \$10.26 per set; \$4.30 per volume.

## MATHEMATICS AT WORK—

by Holbrook L. Horton

Actually three books in one, combined to help you apply your textbook knowledge to practical problems. 100 pages of clear, concise reviews of the fundamentals of arithmetic, algebra, geometry, trigonometry and logarithms. 482 pages of illustrated mechanical problems with step-by-step analyses and solutions. 146 pages of standard mathematical tables needed for all types of problem solving. 196 Illustrations.

**\$7.50** In Canada or overseas, \$8.45.

## 14,000 GEAR RATIOS—

by Ray M. Page

400 pages of tabulated gear ratios and examples—14,000 two-gear, and millions of possible four-gear combinations. Divided into four sections: I—Common Fractional Ratios and Decimal Equivalents. II—Decimal Ratios, Logs and Equivalent Pairs of Gears. III—Total Number of Teeth with Equivalent Gear Pairs and Ratios. IV—Number and Equivalent Gear Factors.

**\$6.50** In Canada or overseas, \$7.60.

## GEAR DESIGN SIMPLIFIED—

by Franklin D. Jones

A new type of book in chart form containing 110 Gear-Problem Charts. Worked-out examples of gear design show exactly how all rules are actually applied in obtaining the essential dimensions, angles, or other values. 201 Drawings. 134 Pages.

**\$4.50** In Canada or overseas, \$5.30.

## DIE-CASTING—2nd Edition—

by Charles O. Herb

Illustrates and describes the latest models of automatic and manually operated die-casting machines. Tables of die-casting alloy compositions include the latest developments and are supplemented by text discussion of their properties and applications. 196 Illustrations. 310 Pages.

**\$5.00** In Canada or overseas, \$5.85.

## PIPE AND TUBE BENDING—

by Paul B. Schubert

Clearly defines the six basic ways by which the bending of ferrous and non-ferrous pipe and tube may be accomplished, with descriptions of these methods, the applications to which they are best adapted and the features of the equipment available. 159 Illustrations. 183 Pages.

**\$5.50** In Canada or overseas, \$6.35.

**MAIL THIS  
ORDER FORM  
TODAY!**

**The Industrial Press, 93 Worth St., New York 13, N. Y.**

Please send me the books listed below, under the terms checked at the right.

.....  
.....  
.....  
.....  
.....  
Name .....  
Company .....  
Street & No. .....  
City ..... Zone ..... State .....

## JIG AND FIXTURE DESIGN—

by Franklin D. Jones

A thorough coverage of the principles of development and constructional details of jigs and fixtures. Designs show principles of construction that can be applied successfully to a variety of jig and fixture design problems. 345 Illustrations. 406 Pages.

**\$5.00** In Canada or overseas, \$5.85.

## MACHINE SHOP TRAINING COURSE—

by Franklin D. Jones

Contains 1124 pages of questions and answers . . . shop problems and solutions . . . blueprint reading charts. Illustrated by 572 drawings and photographs. For use as a textbook, or for designers and production engineers who want the fundamentals of machine shop practice.

**Two-Volume Set, \$9.00**

**Volume I or II separately, \$5.50**

In Canada or overseas, one volume, \$6.45; two volumes, \$10.30.

## MACHINE TOOLS AT WORK—

by Charles O. Herb

An outstanding selection of machine shop operations illustrating the application of modern machine tools. Both standard and special machine tools are shown and data on speed, feed, production, etc. are given for each job. 434 close-up action photographs make it a veritable sightseeing tour through the outstanding machine shops of the United States. 584 Pages.

**\$6.50** In Canada or overseas, \$7.45.

## QUALITY CONTROL—

2nd Edition—by Norbert L. Enrich

Based on plant-tested scientific principles, this edition uses simple tabulated data with direct instructions which anyone can apply. Concrete examples show how statistical quality control is used under different manufacturing conditions. Shows how manufacturers can improve the average quality of their products—and save money at the same time. 38 Charts and Tables. 181 Pages.

**\$4.50** In Canada or overseas, \$5.20.

## CHOOSE YOUR MOST CONVENIENT METHOD OF PAYMENT

I enclose check or money order covering payment in full. (Note prices applying to foreign orders). Send books postpaid.

Send books under Five-Day Free Inspection Plan. If I decide to keep books I will send payment, plus postage charges, within five days.

Bill me       Bill company

Send details of your Time Payment Plan covering the books indicated.

## Product Directory

### PRESSES, EXTRUSION

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wilson, K. R., Inc., Arcade, N. Y.

### PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Ferracutte Machine Co., Bridgeton, N. J.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Products Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wilson, K. R., Arcade, N. Y.

### PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
Ferracutte Machine Co., Bridgeton, N. J.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Minster Machine Co., Minster, Ohio  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

### PRESSES, Notching

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
Ferracutte Machine Co., Bridgeton, N. J.  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Minster Machine Co., Minster, Ohio  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wales-Stripper Co., 345 Payne Ave., N. Tonawanda, N. Y.  
Wilson, K. R., Inc., Arcade, N. Y.

Minster Machine Co., Minster, Ohio  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Nilson, A. H. Machine Co., Bridgeport, Conn.  
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.  
Wales-Stripper Co., 345 Payne Ave., N. Tonawanda, N. Y.  
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, 32, Pa.  
Wilson, K. R., Inc., Arcade, N. Y.

### PRESSES, Quenching

Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
Gleason Wks., 1000 University Ave., Rochester 3, N. Y.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

### PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Chambersburg Engineering Co., Chambersburg, Pa.  
Cincinnati Milling & Grinding Machines, Inc., 4701 Marshall Ave., Cincinnati 9, Ohio  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
Farquhar, A. B. Div., 142 N. Duke St., York, Pa.  
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wilson, K. R., Inc., Arcade, N. Y.

### PRESSES, Trimming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.  
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Chambersburg Engineering Co., Chambersburg, Pa.  
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.  
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio  
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.  
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.  
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio  
Federal Press Co., 511 Division St., Elkhart, Ind.  
Ferracutte Machine Co., Bridgeton, N. J.  
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.  
Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.  
L. & J. Press Corp., 1631 Sterling Ave., Elkhart, Ind.  
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.  
Minster Machine Co., Minster, Ohio  
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.  
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.  
Wilson, K. R., Inc., Arcade, N. Y.

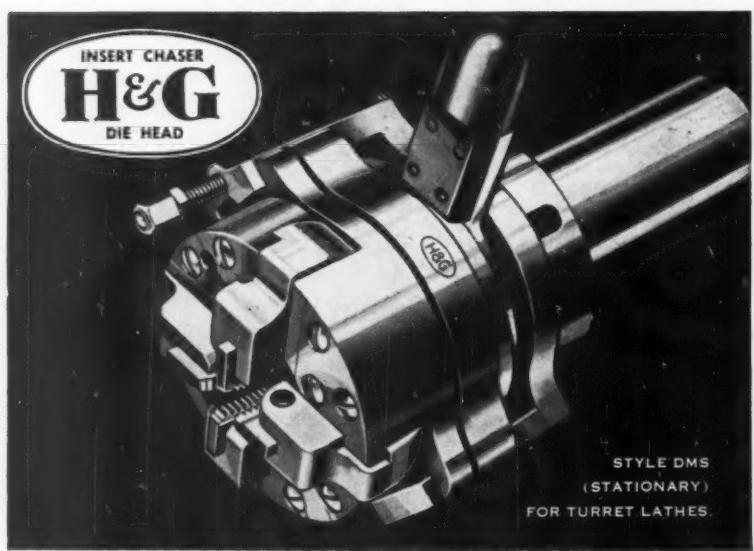
**PROFILING MACHINES**—See Milling Machine, Die Sinking, etc.

### PULLEYS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

### PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Gray-Mills Co., 3705 N. Lincoln Ave., Evanston, Ill.  
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.  
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio  
Viking Pump Co., Cedar Falls, Iowa



### THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: their cost is so low they can be even thrown away when dull. For example, for less than \$45 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

THE EASTERN MACHINE SCREW CORPORATION 23-43 Barclay St., New Haven, Conn.

**PUMPS, Hydraulic**

Barnes, John S., Corp., Rockford, Ill.  
 Brown & Sharpe Mfg. Co., Providence, R. I.  
 Denison Engg. Co., 1160 Dublin St., Columbus  
 16, Ohio  
 Hydraulic Press Mfg. Div., Mount Gilead, Ohio  
 Oilgear Co., 1569 W. Pierce St., Milwaukee,  
 Wis.  
 Sundstrand Machine Tool Co., 2531 11th St.,  
 Rockford, Ill.  
 Vickers Incorporated, Division of Sperry Rand  
 Corp., 1402 Oakman Blvd., Detroit, Mich.  
 Viking Pump Co., Cedar Falls, Iowa  
 Wilson, K. R., Arcade, N. Y.

**PUNCHES AND DIES**—See Dies, Blank-  
 ing, etc.

**REAMERS, Rose, Chucking, Jobbers',  
 Taper, Shell, Adjustable, etc.**

Barber-Colman Co., Rock and Montague, Rock-  
 ford, Ill.  
 Cleveland Twist Drill Co., 1242 E. 49th St.,  
 Cleveland, Ohio  
 DoAll Co., 254 N. Laurel Ave., Des Plaines,  
 Ill.  
 Goddard & Goddard Co., Detroit, Mich.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Heller Tool Co., Heller Dr., Newcomerstown,  
 Ohio  
 National Twist Drill & Tool Co., & Winter  
 Bros. Co., Rochester, Mich.  
 Star Cutter Co., 34500 Grand River, Farmington,  
 Mich.  
 Tomkins-Johnson Co., 617 N. Mechanic St.,  
 Jackson, Mich.  
 Whitman & Barnes, 40600 Plymouth Rd.,  
 Plymouth, Mich.

**REELS, Stock**

National Acme Co., 170 E. 131st St., Cleveland  
 3, Ohio  
 Nilson, A. H. Machine Co., Bridgeport, Conn.  
 U. S. Tool Co., Inc., 255 North 18th St.,  
 Ampere, N. J.

**REFRACTORS, Heat-Treating Furnaces**

Norton Co., 1 New Bond St., Worcester 6,  
 Mass.

**RETAINING RINGS FOR BEARINGS,  
 Etc.**

Walde-Kohinoor, Inc., 4716 Austel Place,  
 Long Island City 1, N. Y.

**RIVETERS, Stationary**

Brown & Sharpe Mfg. Co., 235 Promenade St.,  
 Providence 1, R. I.  
 Chicago Pneumatic Tool Co., 6 E. 44th St.,  
 New York, N. Y.  
 Grant Mfg. & Mch. Co., 90 Silliman Ave.,  
 Bridgeport 5, Conn.  
 Hannifin Corp., 510 S. Wolf Rd., Des Plaines,  
 Ill.  
 Russell, Holbrook & Henderson, Inc., 292 Madison  
 Ave., New York 17, N. Y.  
 Tomkins-Johnson Co., 617 N. Mechanic St.,  
 Jackson, Mich.

**RIVETERS, Portable**

Chicago Pneumatic Tool Co., 6 E. 44th St.,  
 New York, N. Y.  
 Hannifin Corp., 510 S. Wolf Rd., Des Plaines,  
 Ill.  
 Ingersoll-Rand Co., 11 Broadway, New York 4,  
 N. Y.  
 Thor Power Tool Co., Aurora, Ill.

**RULES, SCALES AND STRAIGHTEDGES**

—See Machinists' Small Tools

**RUST INHIBITORS**

Houghton, E. F. & Co., 303 W. Lehigh Ave.,  
 Philadelphia, Pa.  
 Oakite Products, Inc., 19 Rector St., New York  
 N. Y.  
 Scherr, George Co., Inc., 200 Lafayette St.,  
 New York 12, N. Y.  
 Shell Oil Co., 50 W. 50th St., New York, N. Y.  
 Sun Oil Co., 1608 Walnut St., Philadelphia 3,  
 Pa.

**SAND BLAST EQUIPMENT**—See Blast  
 Cleaning Equipment

**SAW BLADES, Hack, Band, Circular,  
 Friction**

Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
 Dale Ave., Chicago, Ill.  
 Circular Tool Co., Inc., 765 Allens Ave., Prov-  
 idence 5, R. I.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.  
 Espen Lucas Mch. Works, Philadelphia, Pa.  
 Motch & Merryweather Mchry. Co., 888 E. 70th  
 St., Cleveland 3, Ohio  
 Simonds Saw & Steel Co., 470 Main St., Fitch-  
 burg, Mass.  
 Starrett, The L. S. Co., Athol, Mass.  
 Tannewitz Works, Grand Rapids, Mich.

Espen-Lucas Machine Works, Front St. and  
 Girard Ave., Philadelphia, Pa.  
 Motch & Merryweather Mchry. Co., Penton  
 Bldg., Cleveland, Ohio

**SAWING MACHINES, Power Hack**

Armstrong-Blum Mfg. Co., 5700 W. Blooming-  
 Dale Ave., Chicago, Ill.  
 Chicago Pneumatic Tool Co., New York 17,  
 N. Y.  
 Homestrand, Inc., Larchmont, N. Y.  
 Thor Power Tool Co., 175 N. State St., Aurora,  
 Ill.

**SAWS, Screw-slotted**—See Cutters,  
 Milling

**SCALES**

Hydroway Scales, Inc., 31302 Stephenson Hwy.,  
 Madison Hts., Mich.

**SCREW DRIVERS, STUD AND NUT  
 SETTERS, Power**

Bodine Corp., 317 Mt. Grove St., Bridgeport 5,  
 Conn.  
 Chicago Pneumatic Tool Co., 6 E. 44th St.,  
 New York, N. Y.  
 Consolidated Mch. Tool Div., Blossom Road,  
 Rochester 10, N. Y.  
 Cross Co., 3250 Bellevue, Detroit 7, Mich.  
 Errington Mech. Lab., Inc., 24 Norwood Ave.,  
 Staten Island 4, N. Y.  
 Ingersoll-Rand Co., 11 Broadway, New York 4,  
 N. Y.  
 Scully-Jones & Co., 1906 S. Rockwell St., Chi-  
 cago 8, Ill.  
 Thor Power Tool Co., Aurora, Illinois  
 Williams & Co., J. H., 400 Vulcan St., Buffalo  
 7, N. Y.

(Continued on page 814)

**SAWING MACHINES, Circular Blade**

Consolidated Mch. Tool Div., Blossom Road,  
 Rochester 10, N. Y.  
 Delta Power Tool Div., Rockwell Mfg. Co.,  
 614G N. Lexington Ave., Pittsburgh 8, Pa.  
 DoAll Co., 254 Laurel Ave., Des Plaines, Ill.

**SAWING MACHINES, Circular Blade**

Flange mounted 18 G.P.M. pump.  
 5G.P.M. hub mounted fuel pump.

A 200 G.P.M.  
 integral mounted  
 lube oil pump for  
 bearing lubrication.

**VIKING PUMPS**

to Your Specifications

Viking lube oil, fuel oil and coolant  
 pumps, built to fit your equipment, are a  
 specialty of Viking.

Shown here are only a few of many  
 special pumps, ranging in size from 5, 10,  
 18, 90 to 200 gallon per minute. Smaller  
 and larger pumps also available. Send to-  
 day for folder 575!



**VIKING PUMP COMPANY**

Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps  
 See our catalog in *Sweets*



**SCREW MACHINES, Hand**—See Lathes, Turret, Ram-type, Saddle-type

**SCREW MACHINES, Single-Spindle Automatic**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio  
Cone Automatic Mch. Co., Inc., Windsor, Vt.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.  
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.  
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., N. Y. 17, N. Y.

**SCREW MACHINES, Multiple-Spindle Automatic**

Cone Automatic Mch. Co., Inc., Windsor, Vt.  
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.  
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.  
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

**SCREW PLATES**

Greenfield Tap & Die Corp., Greenfield, Mass.

**SCREWS, Cap, Set, Self-tapping, etc.—**

See Bolts, Nuts and Screws  
Parker Kalon Div., Clifton, N. J.

**SEALS AND RETAINERS, Oil or Grease**

American Felt Co., Glenville, Conn.  
Crane Packing Co., 1800 Cuylar Ave., Chicago, Ill.  
Garlock Packing Co., Palmyra, N. Y.  
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

**SEPARATORS, Centrifugal**

DeLaval Separator Co., Poughkeepsie, N. Y.

**SEPARATORS, Magnetic**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**SET-UP EQUIPMENT**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Challenge Mchry. Co., Grand Haven, Mich.  
Starrett, The L. S. Co., Athol, Mass.  
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**SHAFTS**

Cumberland Steel Co., 101 Williams St., Cumberland, Md.  
National Forge & Ordnance Co., Irvine, Warren County, Pa.  
Thomson Ind., Inc., Manhasset, N. Y.

**SHAPERS, Crank and Hydraulic**

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.  
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio  
Homestrand, Inc., Larchmont, N. Y.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.  
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.  
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.  
Western Machine Tool Works, Holland, Mich.

**SHAPERS, Vertical and Slotters**

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.  
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.  
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.  
Homestrand, Inc., Larchmont, N. Y.  
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

**SHEARS, Alligator**

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
Lodge & Shipley Co., The, Cincinnati 25, Ohio

**SHEARS, Rotary and Squaring**

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati 25, Ohio  
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.  
Lodge & Shipley Co., The, Cincinnati 25, Ohio  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

**SHEARS, Squaring**

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio  
Lodge & Shipley Co., The, Cincinnati 25, Ohio  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.

**SHEET METALS**—See Strip and Sheet, Ferrous, Non-ferrous

**SHIM STOCK**

Laminated Shim Co., Inc., Glenbrook, Conn.  
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.



"Never mind his left hook — watch out for what HELLER TOOL is going to announce Feb. 1!"

**WORLD'S HARDEST METAL**

• New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

METAL CARBIDES CORPORATION  
**TALIDE®**  
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS  
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS  
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

**SHOP FURNITURE**—See Furniture, Shop

**SLITTING MACHINES, ROTARY**

Bliss Co., E. W., Canton, Ohio  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.  
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

**SLOTTERS**—See Shapers, Vertical and Slotters

**SOLENOIDS**

Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.  
Barnes, John S. Corp., Rockford, Ill.  
General Electric Co., Schenectady, N. Y.  
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio  
Vickers, Inc., Detroit 32, Mich.

**SOCKETS**—See Drill Sleeves and Extension Holders

**SPECIAL MACHINERY AND TOOLS**

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.  
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 38, Cal.  
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.  
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio  
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio  
Bath, Cyril Co., Aurora & Solon Roads, Solon, Ohio  
Barnes Drill Co., 814 Chestnut, Rockford, Ill.  
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.  
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.  
Bethlehem Steel Co., Bethlehem, Pa.  
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.  
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.  
Blanchard Mch. Co., 64 State St., Cambridge, Mass.  
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio  
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.  
Chambersburg Engrg. Co., Chambersburg, Pa.  
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio  
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.  
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio  
Consolidated Mch. Tool Corp., Rochester, N. C.  
Coulter, James, Machine Co., Bridgeport 5, Conn.  
Cross Co., Detroit, Mich.  
Erie Foundry Co., Erie, Pa.  
Espec-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
Federal Machine & Welder Co., Overland Ave., Warren, Ohio  
Fellowes Gear Shaper Co., 78 River St., Springfield, Vt.  
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.  
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.  
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.  
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.  
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

(Continued on page 316)

# FRICITION SAWING

with

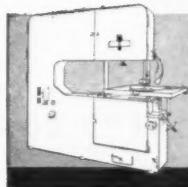
**Tanneewitz**  
HIGH SPEED BAND SAWS

## FASTEAST, BEST MEANS OF CUTTING METALS

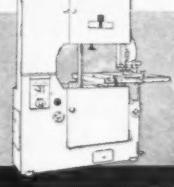
If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tanneewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

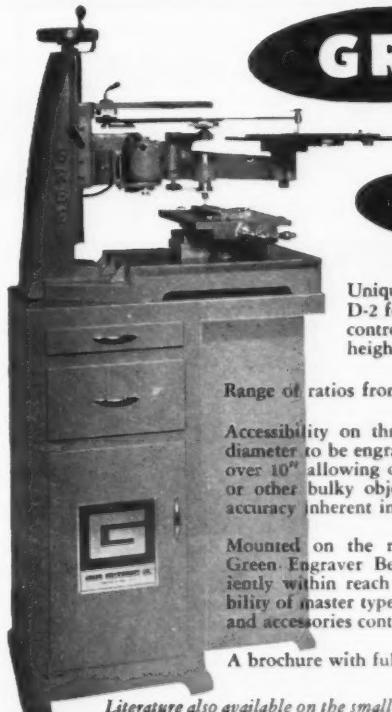


**THE TANNEWITZ WORKS**  GL-6-1729  
**GRAND RAPIDS, MICHIGAN**



**TANNEWITZ DIE-SAWS**  
**24", 36", 48", 60" CAPACITIES**  
for CONTOUR SAWING, FILING, POLISHING  
The smoothest, fastest, most trouble-free Die-Saws on the market. Write for bulletin.





**GREEN**  
**Model D-2**

**Pantograph Engraver**

Unique design of the two-dimensional Model D-2 features — Single micrometer adjustment controls vertical depth of cut, and adjusts height of copy table and pantograph.

Range of ratios from 2 to 1 to infinity!

Accessibility on three sides permitting panels up to 30" diameter to be engraved, milled or profiled. Vertical range over 10" allowing operations on complete chassis, cabinets or other bulky objects. Ruggedness, stability and precise accuracy inherent in construction.

Mounted on the ruggedly constructed heavy duty steel Green Engraver Bench. All functional parts are conveniently within reach of the operator while seated. Accessibility of master type sets stored in lower cabinet trays, tools and accessories contribute to productive capacity.

A brochure with full details is yours upon request.

Literature also available on the smaller Model 106 three-dimensional engraver.

**GREEN INSTRUMENT COMPANY**

64 Putnam Ave., Cambridge, Mass.

## RUTHMAN GUSHER COOLANT PUMPS



**Illustrated is a Rivett 918 Cabinet Turret Lathe equipped with a Model 1-P3—1/10 H.P. Gusher Coolant Pump**

### The Most For Your Money

Moderate in initial cost, Gusher Coolant Pumps are pre-lubricated . . . require no packing . . . are electronically balanced . . . have no metal-to-metal contact within the impeller housing. Vibration and wear are cut to an absolute minimum. You are sure of a long trouble-free life. To save your money always specify Ruthman Gusher Coolant Pumps. Write for our new catalog.

## THE RUTHMAN MACHINERY CO.

1807 Reading Rd.

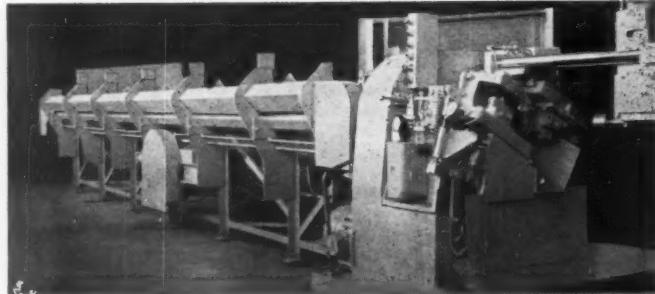


Cincinnati, Ohio



### Why Don't You GO MODERN?

Willy, using grandpa's razor,  
Found it much too sharp and keen.  
He should get a modern type—  
A safety cutting-off machine.



Old methods of cutting-off tubing and bar stock, with tubing diameters up to 8 inches, have been made obsolete by the Modern Automatic Cutting-off Machine and Automatic Stock Feeder.

We have prepared a booklet describing this speedy, accurate, automatic machine. It contains valuable information for any organization interested in faster, cheaper cutting-off operations.

Write for this booklet today!

**MODERN MACHINE TOOL CO.**  
2005 LOSEY AVENUE  
Jackson, Michigan

Hydraulic Press Mfg. Co., Mount Gilead, Ohio  
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.  
Mercury Engrg. Corp., Milwaukee, Wis.  
Michigan Drill Head Co., Detroit 34, Mich.  
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.  
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.  
Moline Tool Co., 102 20th St., Moline, Ill.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio  
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio  
National Acme Co., 170 E. 131st St., Cleveland, Ohio  
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.  
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.  
National Twist Drill & Tool Co., Rochester, Mich.  
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.  
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.  
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.  
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.  
Seneca Falls Mch. Co., Seneca Falls, N. Y.  
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.  
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio  
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.  
Universal Engrg. Co., Frankenmuth 2, Mich.  
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.  
Waltham Machine Works, Newton St., Waltham, Mass.  
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.  
Zagar Tool Co., 2400 Lakeland Blvd., Cleveland 23, Ohio

### SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.  
Boston Gear Works, 320 Main St., North Quincy 71, Mass.  
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.  
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio  
DoAll Co., Des Plaines, Ill.  
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.  
General Electric Co., Schenectady, N. Y.  
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio  
Philadelphia Gear Works, Inc., Erie Ave., and G St., Philadelphia, Pa.  
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

### SPINDLES, Machine

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Michigan Drill Head Co., Van Dyke, Mich.  
National Automatic Tool Co., S. 7th St.-N. St., Richmond, Ind.  
Pop Mchry. Corp., Haverhill, Mass.  
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio  
Wadell Equip. Co., Clark, N. J.

### SPRAYING EQUIPMENT, Metal

Metalizing Engrg. Co., Westbury, N. Y.

### SPROCKETS—See Gears, Cut

### STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.  
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

### STEEL, Cold Rolled, Stainless, High-Speed, Tool, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.

(Continued on page 318)

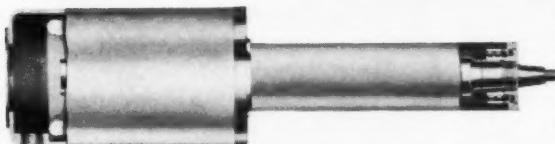
# SEE FOR YOURSELF

why you can be sure of...

- LOW MICROINCH SURFACE FINISHES
- TOLERANCES DOWN IN THE MILLIONTHS
- INCREASED PRODUCTION
- LOWER COSTS

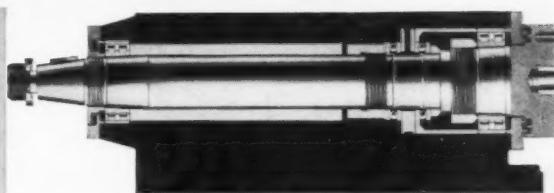
*when you specify...*

## POPE PRECISION SPINDLES



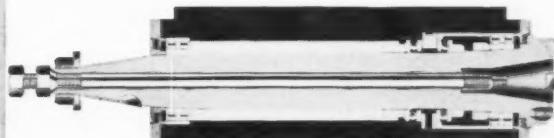
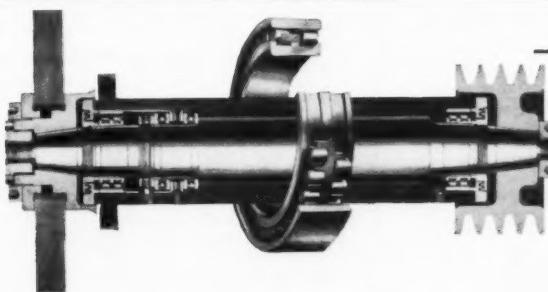
### FOR SURFACE GRINDERS —

POPE 1, 2 and 3 HP, Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with massive shafts and big, double row cylindrical roller bearings having enormous capacity, superior performance and long life.



### FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles for smooth, chatter free, continuous high production of accurate parts. Again, look at the big cylindrical roller bearings and thrust bearings.



### FOR CYLINDRICAL GRINDING —

POPE Cartridge Type and Wheel Head Belt Driven Spindles with the capacity to produce more work whether you plunge grind with a crush dressed wheel, remove surplus metal, or produce low microinch surface finishes. Note the super-precision radial bearings and ball thrust bearings.

### FOR HEAVY DUTY MILLING —

POPE Spindles have the double row cylindrical roller bearings for the extra rigidity to support the cutting tool, and the double direction thrust bearings with the excess capacity to stabilize the shaft against endwise movement in either direction. This adds up to longer cutting tool life, more production, lower cost per piece.

**POPE** engineers and builds standard and special, precision anti-friction bearing Spindles for every purpose. Send us your specifications for prompt quotations.

No. 115

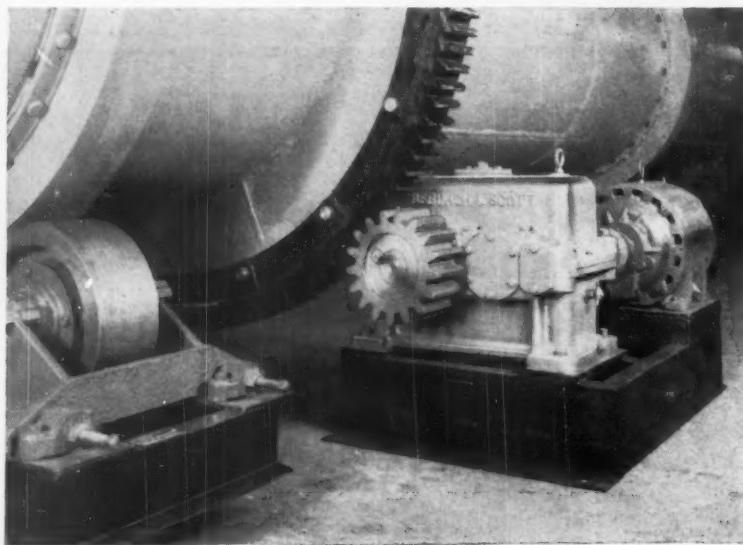
Specify

**POPE**  
PRECISION SPINDLES

POPE MACHINERY CORPORATION

Established 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

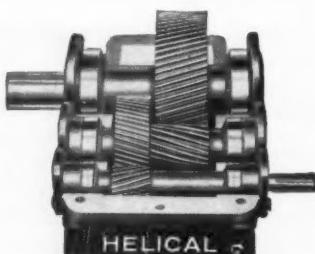


## H & S speed reducer delivers 10 maintenance-free years of continuous service

Manufactured by the Louisville Drying Machinery Unit of the General American Transportation Corp., this Barite Dryer was installed in 1945. The H & S Size 2400 Speed Reducer and H & S Drive Pinion and Gears that you see above have given over 10 maintenance-free years of continuous moderate-shock service.

H & S Herringbone, Helical and Worm Gear Speed Reducers have been serving heavy industry for 26 years. If you are looking for dependable, trouble-free power transmission, won't you contact your H & S representative or write us today?

H & S Reducers are available in single reduction units in ratios up to 100 to 1; in combination units up to 700 to 1; and in double reduction units up to 10,000 to 1.



**H & S Gears:** There are 9 types for you to choose from! Spur Gears are cut up to 144" diameter and 1 D.P. Write today on company letterhead for the new H & S Gear Catalog No. 57.

**THE HORSBURGH & SCOTT CO.**  
GEARS AND SPEED REDUCERS

5112 Hamilton Avenue  
Cleveland 14, Ohio

Columbia Tool Steel Co., Chicago Hts., Ill.  
Crucible Steel Co. of America, Oliver Bldg.,  
Pittsburgh 30, Pa.  
Cumberland Steel Co., 101 Williams St., Cum-  
berland, Md.  
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.  
Simonds Saw & Steel Co., 470 Main St., Fitch-  
burg, Mass.  
Timken Roller Bearing Co., Canton, Ohio  
U. S. Steel Corp., (American Steel & Wire Co.),  
Div., 436 7th Ave., Pittsburgh, Pa.  
Vanadium-Alloys Steel Co., Latrobe, Pa.

### STEEL DISTRIBUTORS

Ryerson, Jos. T., & Son, 16th & Rockwell St.,  
Chicago 8, Ill.

### STOCKS AND DIES

Cyril Bath Co., Solon, Ohio  
DoAll Co., Des Plaines, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2,  
Ohio  
Landis Mch. Co., Waynesboro, Pa.  
Threadwell Tap & Die Co., Greenfield, Mass.

### Straightedges—See Machinists' Small Tools

### Straighteners, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio  
Lewis Machine Co., 3441 E. 76th St., Cleveland  
27, Ohio  
Niagara Mch. & Tool Wks., 637-697 Northland  
Ave., Buffalo 11, N. Y.  
Nilson, A. H. Machine Co., Bridgeport, Conn.  
U. S. Tool Co., Inc., 255 North 18th St.,  
Ampere, N. J.  
Verson Alisteel Press Co., 9309 S. Kenwood  
Ave., Chicago 19, Ill.

### Strip and Sheet, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Bethlehem Steel Co., Bethlehem, Pa.  
Carpenter Steel Co., 105 W. Bern St., Reading,  
Pa.  
Crucible Steel Co. of America, Oliver Bldg.,  
Pittsburgh 30, Pa.  
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th  
St., Chicago 18, Ill.  
U. S. Steel Corp., (American Steel & Wire Co.),  
Div., Carnegie-Illinois Steel Corp., Div., Co-  
lumbia Steel Co., Div., Tennessee Coal, Iron  
& R. R. Co., Div.), 436 7th Ave., Pittsburgh,  
Pa.

### Strip and Sheet, Non-ferrous

American Brass Co., 25 Broadway, New York,  
N. Y.  
Bethlehem Steel Co., Bethlehem, Pa.  
Bridgeport Brass Co., Bridgeport, Conn.  
New Jersey Zinc Co., 160 Front St., New York  
N. Y.  
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,  
Chicago 18, Ill.

### Structural Shapes

Bethlehem Steel Co., Bethlehem, Pa.  
Revere Copper & Brass, Inc., 230 Park Ave.,  
New York 17, N. Y.  
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,  
Chicago 18, Ill.  
U. S. Steel Corp., 525 Wm. Penn Pl., Pitts-  
burgh 30, Pa.

### Stud Setters—See Screwdrivers, etc.

### Superfinishing Equipment

Gisholt Machine Co., 1245 E. Washington Ave.,  
Madison 10, Wis.

### Surface Plates

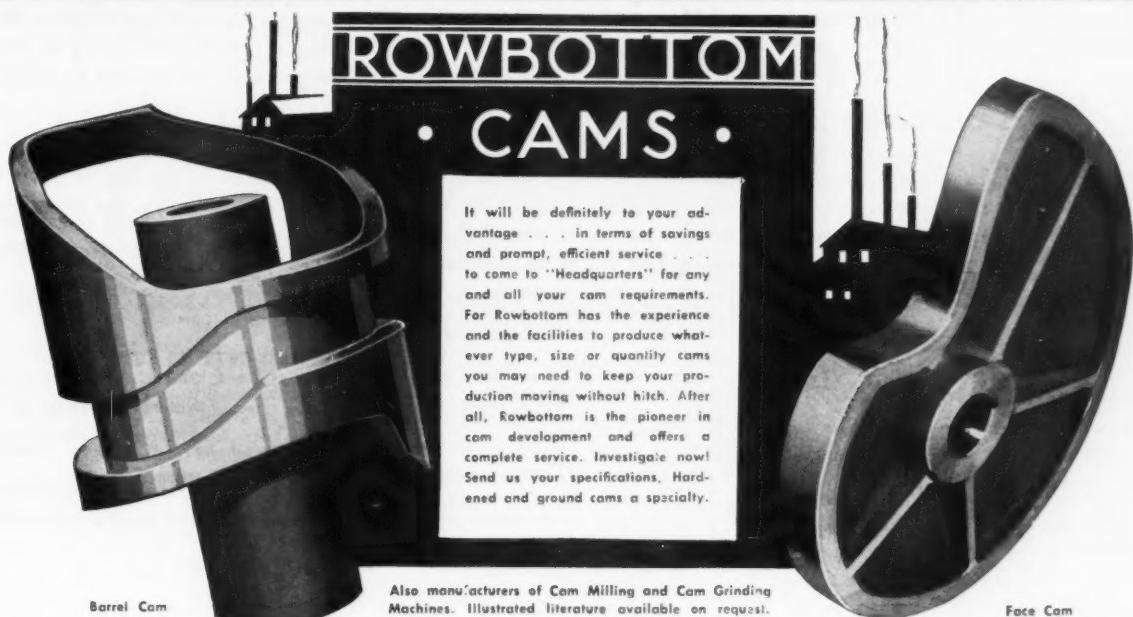
Brown & Sharpe Mfg. Co., 235 Promenade St.,  
Providence 1, R. I.  
Bryant Chucking Grinder Co., Springfield, Vt.  
Challenge Mch. Co., Grand Haven, Mich.  
Delta Power Tool Div., Rockwell Mfg. Co.,  
Pittsburgh, Pa.  
DoAll Co., Des Plaines, Ill.  
South Bend Lathe Wks., South Bend 22, Ind.

(Continued on page 320)

---

**MAKE your NEEDS our RESPONSIBILITY**

---



It will be definitely to your advantage . . . in terms of savings and prompt, efficient service . . . to come to "Headquarters" for any and all your cam requirements. For Rowbottom has the experience and the facilities to produce whatever type, size or quantity cams you may need to keep your production moving without hitch. After all, Rowbottom is the pioneer in cam development and offers a complete service. Investigate now! Send us your specifications. Hardened and ground cams a specialty.

Barrel Cam

Also manufacturers of Cam Milling and Cam Grinding Machines. Illustrated literature available on request.

Face Cam

**THE ROWBOTTOM MACHINE COMPANY.**  
WATERBURY, CONNECTICUT. U.S.A.

*Look into the complete, cost-cutting LOVEJOY line.*

*Standard tools are in stock — to help you increase production, save time and money now!*



**INSERTED-TOOTH MILLING CUTTERS**

Face, side, end, slotting and boring mills.

**H. S. S., CARBIDE, ALLOY BLADES**

Interchangeable in all Type "A" milling cutters from  $4\frac{1}{2}$ " to 24" in diameter.

**NEW! SET-SCREW TYPE END MILLS**

And new Type "Z" slotting cutters provide maximum axial and radial adjustment.

**Boring Tools - Arbors - Flywheels  
Lovejoy Milling Cutter - Assembly Gage**

**Special cutters are a Lovejoy specialty**

Write for new catalogs: No. 31 (Face Mills),  
No. 32 (Side Mills), No. 33 (Arbors).

143 MAIN ST., SPRINGFIELD, VERMONT

Send for free  
**SPEED & FEED  
CALCULATOR**

**LOVEJOY**  
TOOL COMPANY, INC. *Ltc*  
SPRINGFIELD, VERMONT, U.S.A.



"Don't just sit there! Find out what  
HELLER TOOL will announce on Feb. 1!"

**SWITCHES, Limit**

Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.  
Doelcam Div. of Minneapolis-Honeywell, 1400 Soldiers Field Rd., Boston 25, Mass.

**TACHOMETERS**—See Indicators, Speed**TAP HOLDERS**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio  
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.  
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.  
Michigan Drill Head Co., Van Dyke, Mich.  
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.  
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

**TAPPING HEADS**

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio  
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.  
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.  
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.  
Homstrand, Inc., Larchmont, N. Y.  
LaSalle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.  
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.  
Michigan Drill Head Co., 11449 Timken Ave., Van Dyke, Mich.  
Millholland Mch. Co., W.K.M., Indianapolis 20, Ind.  
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.  
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.  
Zagar Co., 24000 Lakeland Blvd., Cleveland 23, Ohio

**TAPPING MACHINES**

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 70, Ohio  
Boush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.  
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.  
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio  
Chicago Pneumatic Tool Co., New York 17, N. Y.  
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.  
Edlund Mchry. Co., 37 Huntington St., Cortland, N. Y.  
Elex Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.  
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.  
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.  
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.  
Kaufman Manufacturing Co., Manitowoc, Wis.  
Kingsbury Mch. Tool Corp., Keene, N. H.  
Landis Mch. Co., Waynesboro, Pa.  
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.  
Michigan Drill Head Co., Van Dyke, Mich.  
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.  
Moline Tool Co., 102 20th St., Moline, Ill.  
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio  
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.  
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio  
Western Machine Tool Works, Holland, Mich.  
Zagar Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**TAPS, Hand, Machine Screw, Pipe, etc.**

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio  
Threadwell Tap & Die Co., Greenfield, Mass.  
Winter Bros. Co., Rochester, Mich.

**TAPS, Collapsing**

Greenfield Tap & Die Corp., Greenfield, Mass.  
Landis Mch. Co., Waynesboro, Pa.  
National Acme Co., 170 E. 131st St., Cleveland, Ohio  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

**THREAD CUTTING MACHINES**

Coulter, James Machine Co., Bridgeport 5, Conn.  
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.  
Eastern Mch. Screw Corp., New Haven, Conn.  
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
Landis Mch. Co., Waynesboro, Pa.  
Lees-Brader Co., Cleveland, Ohio  
Michigan Drill Head Co., Van Dyke, Mich.  
Sheffield Corp., Dayton 1, Ohio

**THREAD CUTTING TOOLS**

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.  
Coulter, James Machine Co., Bridgeport 5, Conn.  
Eastern Mch. Screw Corp., New Haven, Conn.  
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio  
Landis Mch. Co., Waynesboro, Pa.  
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio  
Star Cutter Co., 34500 Grand River, Farmington, Mich.

**THREAD ROLLING DIES**—See Dies,  
Thread Rolling

**THREAD ROLLING EQUIPMENT**

Landis Machine Co., Waynesboro, Pa.  
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio  
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.  
Sheffield Corp., Dayton 1, Ohio

**TOOL CONTROL BOARDS**

Cross Co., 3250 Bellevue, Detroit 7, Mich.  
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich.  
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

**TOOL HOLDERS**

Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., So. Beloit, Ill.  
Bridgeport Mches. Inc., 500 Lindley St., Bridgeport 6, Conn.  
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.  
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio  
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio  
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.  
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.  
Eastern Mch. Screw Corp., Truman & Barclay Sts., New Haven 6, Conn.  
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio  
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.  
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)  
Vascoloy-Ramet Corp., North Chicago, Ill.  
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.  
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**TOOL MATERIAL, Cast Non-Ferrous Alloy**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Haynes Stellite Co., 725 So. Lindsay St., Kokomo, Ind.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Vascoloy-Ramet Corp., North Chicago, Ill.

(Continued on page 322)



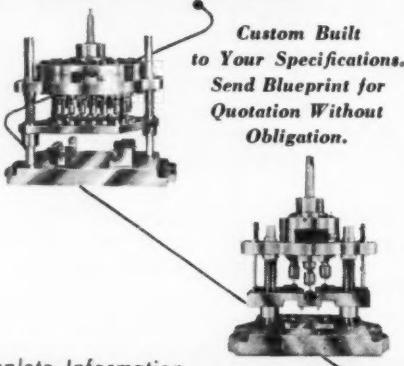
Do more . . . and do it better with Errington Fixed Center Drilling Heads. They drill any number of varied size holes on different elevations. The head has grooved thrust ball bearings at all thrust points and hardened bronze radial bearings. Heat treated spindles and gears, of one piece turned from solid bar stock. It is geared approximately 2:1. All enclosed in a sand-cast aluminum case and cover, with alemite pressure lubrication.

Write for Complete Information

**ERRINGTON Mechanical Laboratory, Inc.**

Established 1891

Main Office and Plant, STATEN ISLAND 4, NEW YORK





"Take them all if you'll just  
tell me what HELLER TOOL will  
announce Feb. 1!"

Stahl craftsmanship supplied this answer to heavy industry's need for a precise, durable spur gear to be used on a 60 ton crane. For similar, or widely varied uses, Stahl has the precision facilities to more than satisfy your gear needs—in any material, in any quantity. Get our estimate.

*Stahl*

GEAR & MACHINE COMPANY  
3901 Hamilton Ave. Cleveland 14, Ohio

SPURS TO 72" PD, 1 DP  
BEVELS TO 54" PD, 1 DP  
SPIRAL, HELICAL and WORM GEARS  
TO 48" PD, 2 DP  
CONTINUOUS-TOTH HERRINGBONE  
TO 60" PD, 2 DP  
SPROCKETS TO 72" PD, 2½" CP  
RACKS TO 20 FT. LONG, 3 DP  
SILENT GEARS,  
RAWHIDE, BAKELITE, FIBROL  
HEAT-TREATED, CASE OR FLAME  
HARDENED GEARS—  
OF CARBON OR ALLOY STEEL

## FOR WORMS AND WORM GEARS **BILGRAM** IS THE ANSWER!

ALL TYPES  
OF GEARS



If you need worms and worm gears, come to BILGRAM. With over 70 years' experience, specially designed equipment and a fully modern plant, we can supply you with gears that meet your exact specifications for accuracy, performance and quality.

We are equipped to fill all your gear needs: Bevel Gears with straight or spiral cut teeth . . . Ellipticals . . . Herringbones . . . Helicals . . . Racks . . . Spurs . . . Hypoids . . . as well as Worms. Get BILGRAM estimate on your next gear needs.



FOR ALL TYPES OF  
GEARS CALL

**BILGRAM**  
GEAR & MACHINE WORKS

Manufacturers of Bevel Gear Generators  
and Chamfering Machines

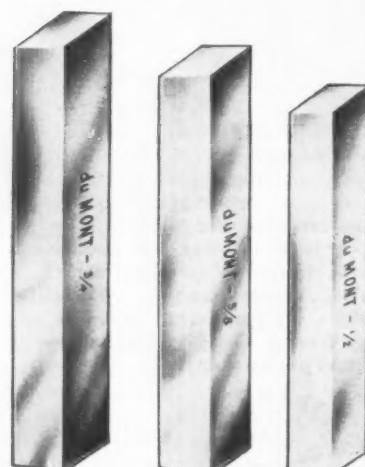
1217-35 SPRING GARDEN ST.  
PHILADELPHIA 23, PA.

## duMONT PERFECTS BALANCE --ADDS TO TOOL BIT LIFE



An almost perfect balance of toughness, wear resistance and heat resistance gives duMONT Tool Bits a definite edge in cutting life, gives you more cuts per bit, more cuts per dollar.

Clip the coupon to get full information on these long-life, high speed tool bits, ground square and rectangular.



**The duMONT CORPORATION**  
**Greenfield, Massachusetts**

MAIL FREE Tool Bit COMPARISON  
CHART, CATALOG and PRICE LIST  
M to

Name.....

Company.....

Address .....

### TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Apex Tool & Cutter Co., Inc., 235 Canal St.,  
Shelton, Conn.  
Armstrong Bros. Tool Co., 5213 W. Armstrong  
Ave., Chicago 30, Ill.  
Besly-Welles Corp., 112 Dearborn Ave., Beloit,  
Wis.  
Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland, Ohio  
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.  
Eclipse Counterbore Co., 1600 Bonner Ave.,  
Ferndale, Mich.  
Kennametal, Inc., Latrobe, Pa.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Metal Carbides Corp., Youngstown 12, Ohio  
Spiral Step Tool Co., Chicago 25, Ill.  
Star Cutter Co., 34500 Grand River, Farming-  
ton, Mich.  
Vascloy-Ramet Corp., North Chicago, Ill.  
Wesson Co., 1220 Woodward Heights Blvd.,  
Ferndale, Mich.

### TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio  
Norton Co., 1 New Bond St., Worcester 6,  
Mass.

### TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Apex Tool & Cutter Co., Inc., 235 Canal St.,  
Shelton, Conn.  
Armstrong Bros. Tool Co., 5213 W. Armstrong  
Ave., Chicago 30, Ill.  
Carpenter Steel Co., Reading, Pa.  
Cleveland Twist Drill Co., 1242 E. 49th St.,  
Cleveland 14, Ohio  
Crucible Steel Co. of America, Oliver Bldg.,  
Pittsburgh 30, Pa.  
du Mont Corp., 289 Wells St., Greenfield, Mass.  
Eclipse Counterbore Co., 1600 Bonner Ave.,  
Detroit 30, Mich.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Spiral Step Tool Co., 5400 N. Damen Ave.,  
Chicago 25, Ill.  
Star Cutter Co., 34500 Grand River, Farming-  
ton, Mich.  
Vanadium Alloys Steel Co., Latrobe, Pa.

### TRACING ATTACHMENTS

American Tool Works Co., Cincinnati 2, Ohio  
Atlas Press Co., Kalamazoo, Mich.  
Gisholt Mch. Co., 1245 E. Washington Ave.,  
Madison 10, Wis.  
Gorton Mch. Co., 1321 Racine St., Racine, Wis.  
Jones & Lamson Mch. Co., 512 Clinton St.,  
Springfield, Vt.  
Sidney Mch. Tool Co., Sidney, Ohio  
Wales-Strippit Co., N. Tonawanda, N. Y.  
Warren & Swasey, 5701 Carnegie Ave., Cleve-  
land 3, Ohio

### TRANSFER MACHINES, Automatic—

See Multiple-Station Machines

### TRANSMISSION, Variable Speed

Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Barnes, John S. Corp., Rockford, Ill.  
Boston Gear Wks., Quincy, Mass.  
Cleveland Worm & Gear Co., 3249 E. 80th St.,  
Cleveland 4, Ohio  
Oilgear Co., 1569 W. Pierce St., Milwaukee,  
Wis.  
Reliance Electric & Engrg. Co., 1047 Ivanhoe  
Rd., Cleveland 10, Ohio  
Vickers, Inc., Detroit 32, Mich.

### TRUCKS, Material Handling

Hamilton Tool Co., 834 So. 9th St., Hamilton,  
Ohio

### TUBE-FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman Ave.,  
Bridgeport 5, Conn.  
Niagara Mch. & Tool Wks., 637-697 Northland  
Ave., Buffalo 11, N. Y.

### TUBE FORMING AND WELDING MACHINES

Yoder Co., 550 Walworth Ave., Cleveland, Ohio

### TUBE MILLS

Etna Machine Co., Perrysburg, Ohio  
Yoder Co., 550 Walworth Ave., Cleveland, Ohio

### TUBING, Non-ferrous

American Brass Co., 25 Broadway, New York,  
N. Y.  
Bridgeport Brass Co., Bridgeport, Conn.  
Mueller Brass Co., Port Huron 34, Mich.  
Revere Copper & Brass Inc., 230 Park Ave.,  
New York, N. Y.  
Ryerson & Son, Inc., Jos. T., 2558 W. 16th St.,  
Chicago 18, Ill.

### TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
Babcock & Wilcox Co., Beaver Falls, Pa.  
Carpenter Steel Co., Reading, Pa.  
Crucible Steel Co. of America, Henry W.  
Oliver Bldg., Mellon Square, Pittsburgh 22,  
Pa.  
National Tube Div., U. S. Steel Corp., 525 Wm.  
Penn Place, Pittsburgh, Pa.  
Revere Copper & Brass, Inc., 230 Park Ave.,  
New York 17, N. Y.  
Ryerson, Jos. T. & Son, 2559 W. 16th St.,  
Chicago 18, Ill.  
Timken Roller Bearing Co., Canton, Ohio

### ULTRASONIC MCH. TOOLS

Sheffield Corp., Dayton 1, Ohio

### UNIT HEATERS, Electric

General Electric Co., Schenectady, N. Y.

### VALVE CONTROLS

Barnes, John S. Corp., Rockford, Ill.  
Logansport Mch. Co., Inc., Logansport, Ind.  
Philadelphia Gear Works (Motorized), Erie Ave.  
and G St., Philadelphia, Pa.  
Vickers, Inc., Detroit 32, Mich.

### VALVES, Air

Bridgeport Brass Co., 30 Grand St., Bridgeport  
2, Conn.  
Hannifin Corp., 510 S. Wolf Rd., Des Plaines,  
Ill.  
Hunt, C. B., & Son, Inc., 1911 E. Pershing St.,  
Salem, Ohio  
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio  
Logansport Mch. Co., Inc., Logansport, Ind.  
Numerics, Inc., Milford, Mich.  
Schroeder's Son, A., 470 Vanderbilt Ave.,  
Brooklyn 38, N. Y.  
Skinner Chuck Co., 95 Edgewood Ave., New  
Britain, Conn.  
Tomkins-Johnson Co., 617 N. Mechanic St.,  
Jackson, Mich.

### VALVES, Hydraulic

Barnes, John S. Corp., Rockford, Ill.  
Denison Engrg. Co., 1160 Dublin St., Columbus  
16, Ohio  
Hunt, C. B., & Son, 1911 E. Pershing St.,  
Salem, Ohio  
Hydraulic Press Mfg. Div., Mount Gilead, Ohio  
Logansport Machine, Inc., 810 Center Ave.,  
Logansport, Ind.  
Oilgear Co., 1569 W. Pierce St., Milwaukee,  
Wis.  
Vickers Incorporated, Division of Sperry Rand  
Corp., 1402 Oakman Blvd., Detroit, Mich.

**VERNERS**—See Calipers, Vernier;  
Gages, Vernier

### VISES, Machine

Bridgeport Mches., Inc., 500 Lindley St.,  
Bridgeport 6, Conn.  
Brown & Sharpe Mfg. Co., Providence, R. I.  
Cincinnati Milling & Grinding Mches., Inc.,  
4701 Marburg Ave., Cincinnati 9, Ohio  
Cincinnati Milling Mch. Co., Oakley, Cincinnati  
9, Ohio  
Delta Power Tool Div., Rockwell Mfg. Co.,  
Pittsburgh, Pa.  
Logansport Machine Co., Inc., 810 Center Ave.,  
Logansport, Ind.  
Modern Mch. Tool Co., 2005 Losey Ave.,  
Jackson, Mich.

(Continued on page 324)



## BUILD YOUR OWN AUTOMATIC DRILLING OR TAPPING MACHINE

With Govro-Nelson Automatic Drilling and Tapping Units, together with the bases and electrical controls which we can supply, you can build yourself an automatic drilling or tapping machine at substantially lower cost than a special machine.

Any number of units may be employed. Examples of the various ways in which they may be arranged are shown at the right.

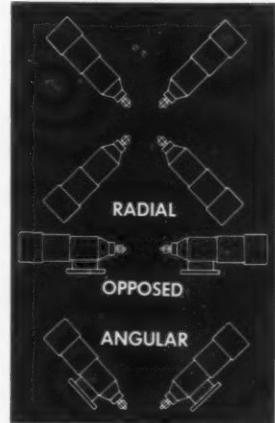
### DRILLING UNITS

The Drilling Units are made in several sizes with spindle speeds from 1100 to

3450 RPM. Drill Units have full Hydraulic Control with external adjustment for the rapid approach, the rate of feed and the length of stroke. Suitable for drills up to  $\frac{1}{2}$ ", depending on material.

### TAPPING UNITS

The Tapping Units are available in two sizes with 550 and 1725 RPM spindle speed. Features include no clutch and no lead screw and automatic adjustment for various leads. Suitable for tapping 0-80 to  $\frac{1}{2}$ -16, depending on material.



**Write for literature**

### Automatic DRILLING UNIT

**GOVRO-NELSON CO.**

Machinists of Precision Parts for 34 Years

1933 ANTOINETTE

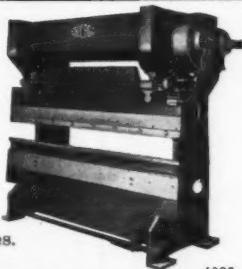
DETROIT 8, MICH.



### STEEL PRESS BRAKES

#### 43 Standard Sizes

**DIES** Punching and Forming for All Makes and Sizes of Press Brakes.



4908



### GEARS - ALL MAKES . . . Special and Standard

PRECISION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy, Quality, and Fine Workmanship

**NEW JERSEY GEAR & MFG. CO.**  
1470 Chestnut Ave. Hillside, N. J.



### CAMS

ALL TYPES  
MADE TO  
YOUR SPECS!



Mfrs' agents wanted



Dr. Chas. Eisler M.E., Founder  
Chas. Eisler, Jr., Pres.

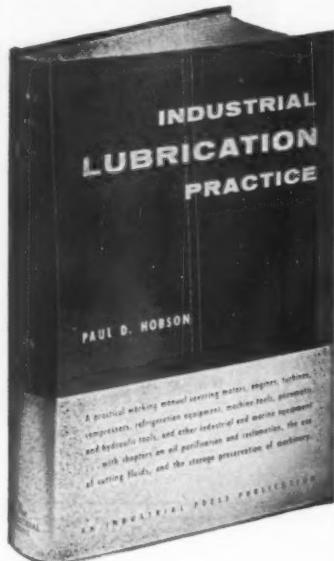
**EISLER ENGINEERING CO., INC.**

738 SOUTH 13TH STREET  
NEWARK 3, N. J. U. S. A.

"All he can say is, 'What's HELLER TOOL  
going to announce Feb. 12?'"

# ANSWERS YOUR QUESTIONS ON . . . INDUSTRIAL LUBRICATION PRACTICE

This book is a guide to sound lubricating practice and its application to cost-saving machine operation and maintenance, and intelligent trouble-shooting. It provides valuable information for all who are responsible for the trouble-free, efficient operation of machinery, mechanical equipment and the prime movers which drive it.



**534 Pages  
167 Illustrations**

**\$8.00**

In Canada or overseas, \$8.95

When you buy this compact yet comprehensive lubrication manual you will have at your fingertips a wealth of ready-to-use information to help you . . .

1. Clearly understand the fundamental principles of lubrication.
2. Become acquainted with the wide range of lubricants, both natural and synthetic—their advantages and disadvantages, and their applications.
3. Know the many different kinds of plain and anti-friction bearings that are used in today's machinery and the ways in which they function.
4. See how approved methods of supplying lubricant to bearings can be applied.
5. Follow a tested and life-extending method of running in new bearings.
6. Review the important factors in the lubrication of industrial machinery and equipment.
7. Organize a lubrication department with an efficient storage arrangement and an economical selection of lubricants.
8. Understand the nature of different deterioration products and contaminants.
9. Quickly select a machine tool cutting oil adapted to the type of operation and the kind of material being machined.
10. Prepare all types of machinery for safe rust- and corrosion-free storage.

Send for your copy of **INDUSTRIAL LUBRICATION PRACTICE** today. In one convenient volume it will give you clear-cut, authoritative answers to many of your most perplexing problems. Just mail the convenient order form below, and the book will be sent immediately. You may return it within five days if you do not find it completely satisfactory. If you send payment in full with your order we pay the postage. Same return privilege applies, of course.

## ----- MAIL THIS ORDER FORM TODAY -----

**THE INDUSTRIAL PRESS, 93 Worth Street, New York 13, N. Y.**

Please send me a copy of **INDUSTRIAL LUBRICATION PRACTICE**.

I enclose check or money order in full payment. Send book postpaid.  
 Bill me.  Bill Company.

(\$8.00 in U.S. \$8.95 in Canada or overseas)

Name ..... Position .....

Firm .....

Firm Address .....

City .....

Home Address .....

(Fill in if you want book sent home)

M-1/57

Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.  
Universal Engineering Co., Frankenmuth 2, Mich.  
Wesson Co., 1220 Woodward Hghts. Blvd., Detroit 20, Mich.

### WELDING EQUIPMENT, Arc

General Electric Co., Schenectady, N. Y.  
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio  
Linde Air Products Co., New York 17, N. Y.

### WELDING EQUIPMENT, Gas

Linde Air Products Co., New York 17, N. Y.

### WELDING EQUIPMENT, Resistance

Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.  
Federal Mch. & Welder Co., Warren, Ohio

### WELDING POSITIONERS

Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

### WELDMENTS

Bliss, E. W., Co., Canton, Ohio  
Farrel-Birmingham Co., Inc., Ansonia, Conn.  
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### WIPERS

Scott Paper Co., Chester, Pa.

### WIRE

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.  
(Stainless)  
Bethlehem Steel Co., Bethlehem, Pa.  
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.  
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.  
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.) 436 7th Ave., Pittsburgh, Pa.

### WIRE FORMING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.  
Cosco Corp., 405 Lexington Ave., New York 17, N. Y.  
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.  
Nilson, A. H. Machine Co., Bridgeport, Conn.  
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### WOODWORKING MACHINES

Atlas Press Co., Kalamazoo, Mich.  
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.  
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio  
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.  
Pope Mchry. Corp., Haverhill, Mass.

### WRENCHES, Allen, End, Socket, Adjustable, etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.  
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.  
Chicago Pneumatic Tool Co., New York 17, N. Y.  
Standard Pressed Steel Co., Jenkintown, Pa.  
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

### ZINC

New Jersey Zinc Co., 160 Front St., New York, N. Y.

# Let ETTCO help you **plan** on production drilling and tapping of small holes *. . . at a realistic investment!*



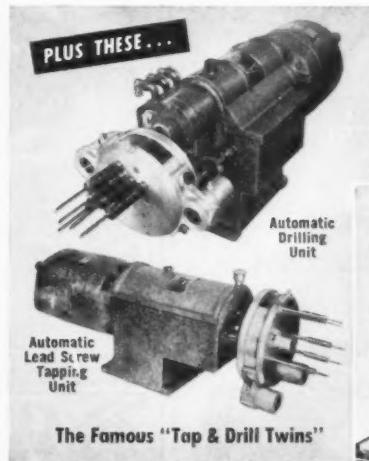
The only full line manufacturer of  
drilling and tapping equipment covering  
the entire small hole field

If you've discarded the idea of multiple drilling and tapping small holes because of heavy initial investment, that's another reason why it pays to plan with Ettco.

Ettco-Emrick equipment is built of standardized "Unit-Engineered" parts and fewer parts — most of which are interchangeable and reusable for many other jobs.

And since Ettco concentrates solely on the manufacture of small hole equipment, you can be sure the unit or machine recommended is *exactly* suited to the job; highly efficient, yet never expensively over-powered — thus realistically priced.

Let's prove it! Send us a sample part and background information on your production requirements and we'll report immediately. Ask for our catalog, too. It's quite helpful and informative.



See these few examples of Ettco  
drill & tap planning



These pictures are typical of Ettco-Emrick "Unit-Engineering." Standard multiple heads and work holding fixtures as well as the famous "Twins" can easily be assembled in any combination to make fast, high production special drilling and tapping machines at realistic prices to suit your small hole needs. The "Twins" may be used separately or in unlimited combination — single spindle or with multiple heads as required.

Authorized Ettco distributors are ready to serve you throughout the U.S. and Canada



**ETTCO TOOL & MACHINE CO., INC.**

592 Johnson Avenue, Brooklyn 37, N. Y.

Chicago • Detroit • Los Angeles • Indianapolis

TAPPING ATTACHMENTS • MULTIPLE HEADS • DRILLING & TAPPING UNITS AND MACHINES  
SPECIAL MACHINES • INDEXING FIXTURES • TAP & DRILL CHUCKS



"And now for \$64,000... what's  
HELLER TOOL going to announce Feb. 1?"

**REDUCE PRODUCTION COSTS**

Eliminate Extra Operations — Use Spiral's "Multiple-Operation" Step Tools

Carbide and High Speed

Step drills, step reamers, milling cutters, seating and grooving tools, trepanning tools, form tools, carbide and high speed, made to your specs or designed by our engineers to fit your needs. Form ground with "radial relief" gives up to 500% more tool life, imparts smoother finishes on piece parts. Send for details.

**SPIRAL**  
STEP TOOL COMPANY

Designers and Manufacturers of All Types of Special Cutting Tools

5400 N. Damen Avenue • Chicago 25, Illinois  
Phone: LONGbeach 1-5284

## New SCHERR TOOLMAKERS MICROSCOPE

WITH INTERCHANGEABLE DIAL TEMPLETS AND OCULARS

Reading Angles in Minutes

Thread Templets for U. S. National Thread Profiles - 6-80 Pitch, Radii Templets, etc.

LARGE MICROMETER DRUMS READ DIRECTLY IN .0001"

Measuring Range 2" x 1-1/2" and other sizes

A moderately priced PRECISION MEASURING TOOL for Toolroom and Inspection

WRITE FOR CATALOG — Code YGIIQ

**GEORGE SCHERR CO., Inc.**  
COMPLETE LINE OF PRECISION INSTRUMENTS  
200 MA LAFAYETTE STREET • NEW YORK 12, N.Y.

**DYKEM STEEL BLUE**

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

With DYKEM Steel Blue Without DYKEM Steel Blue

THE DYKEM COMPANY  
2303R North 11th St. • St. Louis 6, Mo.

**CUT SCRAPER TIME**  
END NIGHT CLEANUP & MORNING REBLUING

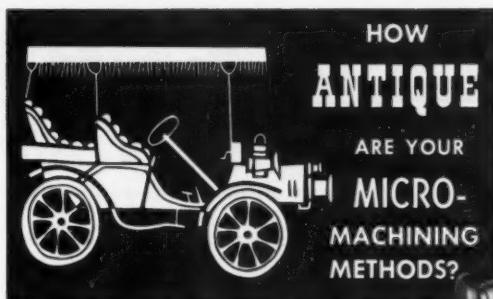
DYKEM HI-SPOT BLUE No. 107 is used to locate high spots while scraping bearing surfaces. As it does not dry, it remains in position on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit, noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO.

**IMPROVE FACING OPERATIONS**  
ON BORING MILLS - DRILLS - LATHE  
MILLERS AND RADIALS

M-D facing Head feeds automatically. Lathe tool bit travels radially from center outward or reverse. 10 sizes, 6" to 48" dia. Write for bulletin, prices.

**MUMMERT-DIXON CO.** 126 Philadelphia St.  
HANOVER, PA.

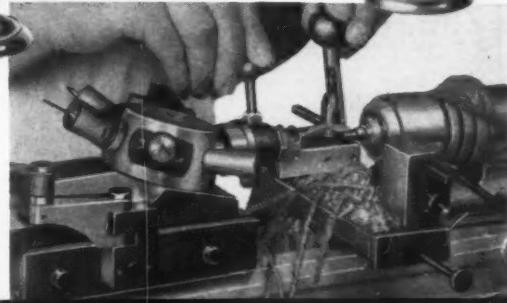


YOU CAN PRODUCE SMALL INSTRUMENT PARTS  
WITH MORE  
ACCURACY • ECONOMY and SPEED

## LEVIN<sup>®</sup> TURRET LATHES

A small precision turret lathe for second operations and production of instrument parts. Available in two collet capacities, 5/16" or 3/16". The 6 position turret is self indexing and has hardened ways. Turret holes are 1/2" diameter. Turret travel 1-5/8". The cross slide has a swivel side at one end and a rigid tool block at the other. Lever collet closer provides quick opening and closing. A variety of turret tools with 1/2" shanks is available.

Send for catalog M describing complete line of instrument lathes, micro-drilling equipment and accessories.



LOUIS LEVIN & SON, INC.—3610 S. BROADWAY—LOS ANGELES 7, CALIFORNIA



### B. & R. B. PRECISION BEARINGS

are selected for dependability. They are designed and manufactured for endurance. Standard sizes are available from stock. Write for general catalog No. 20.

THE BALL & ROLLER BEARING CO.  
DANBURY, CONN.



### RUSSELL HYDRAULIC SAWING MACHINES

all sizes up to 14" capacity,  
with or without automatic stock feed

Ask for catalog

TRIPLEX MACHINE TOOL CORP.  
75 West St. New York 6, N. Y.

### PALMGREN

#### Machine Vises and Rotary Tables



No. 608 6" Swivel  
Machine Vise, \$99.95



Write for Catalog 204 No. 83 8" Rotary Table, \$79.95

CHICAGO TOOL AND ENGINEERING CO., 8387 S. Chicago Ave., Chicago 17, Ill.



"Aw lemme go — I wanna find out what  
HELLER TOOL will announce Feb. 1!"

# Classified and Re-Sale Section

## Eastern Rebuilt Machine Tools

**THE SIGN OF QUALITY  
THE MARK OF DEPENDABILITY**

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS

### TAPPERS

- No. 1 Bakewell, m.d., late
- No. 1 Haskins, pneumatic control, type 1 CAP
- No. 2 Haskins, pneumatic control, type 2 CAP
- No. 3 Haskins, pneumatic control, type 3 CAP
- Acme Semi-Automatic 6 spindle, 1½", arranged for m.d.
- No. 3C Haskins, pneumatic control, type 3 CAM, m.d.
- 2 spindle Haskins, pneumatic control, m.d.
- No. 22 Murray, 6" 28" pitch
- 3 way Auto Tapper & Drill
- No. 10 Model 2100 Warner & Swasey Bench Model Tapping Machine, m.d.

### SHEET METAL MACHINERY

- No. 2 Lbert Nibbler, 28" throat
- No. 3-½" capacity Gray Sheet Metal Cutter, m.d.
- 12" x ¾" cap. Dreis & Krump Leaf Brake, m.d.
- Size 848 Model 0 Parker Tube Bender, hand operated
- No. 6 Niles Pyramid Type Plate Bending Roll, 12" x ¾", m.d.
- No. 1-SPC Buffalo Armor Plate Bar Cutter, m.d.
- No. 47 Buffalo Double End Shear and Bar Cutter, m.d.
- Model 1236 High Speed Nibbler Type Shear, m.d.
- Web Model BB-6 Pyramid Type Plate Bending Roll, Brand New
- Gray Turret Head Metal Cutter, m.d.
- No. 3 Ryerson Rotary Bevel Shear
- #6½" Hills & Jones Gate Shear
- No. 1016 Wyman & Miles Power Squaring Shear, m.d.

### TURRET LATHES AND SCREW MACHINES

- No. 601 W.D. Oster Geared Head Rapiduction, m.d., chucking
- No. 1 Warner & Swasey "Electric," m.d., bar
- No. 1L Gisholt Universal, m.d., 1943
- No. 1, 2 Cincinnati Acme Full Universal, m.d.
- No. 2 Warner & Swasey Ram Type, m.d.
- No. 2A Warner & Swasey, m.d., preselector head, late
- No. 2B Foster Fasternatic, m.d., Timken
- No. 2L Gisholt Universal, m.d., latest type, 1945
- No. 3 Warner & Swasey Universal Ram Type, m.d.
- No. 3 Cincinnati Acme Full Universal, m.d., chucking
- No. 3 Foster Geared Head, m.d.
- No. 3 Jones & Lamson, m.d., 1943
- No. 3A Warner & Swasey, m.d., 1942
- No. 3F Foster Fasternatic, m.d., Timken
- No. 4 Midland Universal Ram Type, m.d.
- No. 4 Warner & Swasey, cone, bar and chucking types
- No. 4A Warner & Swasey Universal, m.d., chucking, 1939
- No. 4L Gisholt Universal, m.d., 1943
- No. 4FU Foster Fasternatic, m.d., latest, 1945
- No. 7A Jones & Lamson Universal
- No. 5 Bardons & Oliver Ram Type Universal
- No. 5½" Pratt & Whitney Hand Screw Machine, cone, bar 2½" x 3" Jones & Lamson Geared Head, m.d., bar and chucking
- 4½" x 4" Jones & Lamson Geared Head, m.d.
- 18" Libby Type A, m.d., chucking
- 20" Acme, a.p.d., bar
- 20" Dreses, arranged for factory m.d.
- 26" Libby Type C, m.d., chucking
- No. 16-H Libby, m.d.
- 6.2 Denver Acme Full Universal, m.d.

The above is only a partial listing

WRITE FOR COMPLETE STOCK LISTING

## THE EASTERN MACHINERY COMPANY

1006 Tennessee Avenue, Cincinnati 29, Ohio

• Melrose 1-1241 • Cable Address EMCO

Well-established Cleveland firm of sales engineers, operating throughout northern Ohio, presently representing nationally known machine tool manufacturers exclusively, open for one additional account. We offer considerable experience, versatility, and competence in sales engineering, with thorough knowledge and coverage of territory. Interested only in American quality line backed by good engineering and manufacturing facilities.

Write Box 708, care of Machinery Magazine, 93 Worth St., New York 13, N.Y.

### BRITISH

Machine shop equipped first class medium size plant seeks small batch or special parts work from the U. S. Capacity for complete machine building with 6 Ton overhead crane. Trials welcomed, firm prices given.

BALDING Engineering Ltd.  
Sandy Lane, Norwich,  
ENGLAND

### MACHINE TOOLS

- No. 2 Niles-Bement-Pond Axle Lathe, m.d.
- No. 3 Niles-Bement-Pond Axle Lathe, m.d.
- 52" Bettis Car Wheel Borer
- 90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
- 90" Niles Journal Lathe, including 2 inside Journal Turrets and 3½" spindle double quartering attachment, m.d.
- 90" Niles Driving Wheel Lathe, m.d., latest
- No. 3 Bettis Bridgeford Axle Lathe, m.d.

### SHAPERS

- No. 14 Cochran Bly Vertical Shaper, m.d.
- Pratt & Whitney M1506, Model B Vertical Shaper
- 16" Smith & Edwards Universal, m.d.
- Hendry Back Geared Crank Shaper, m.d.
- Potter & Johnson, cone
- 32" Morton Draw-cut, m.d., late
- Ohio Shaper, m.d.
- Cincinnati, m.d., late
- 32" Columbia H.D. Plain Back Geared Crank Shaper, m.d.
- 36" Morton Draw-Cut, m.d., late
- 36" Rockford Universal Openside Shaper Planer, m.d.
- 38" Morton Draw-Cut Shaper

- 48" Cincinnati Automatic Duplex Milling Machine, Motor Driven.

### FALK MACHINERY CO.

19 Ward Street — BA 5-5887 — Rochester, N. Y.

### "Key to Preventive Maintenance"

### MACHINE TOOL RECONDITIONING

& the Art of Hand Scraping (new 2nd printing)  
useful for design, shop & inspection work—  
Write for folder describing illustrated book.

### MACHINE TOOL PUBLICATIONS

215 Commerce Bldg. South Wabash St.  
St. Paul 1, Minn.

An efficient German factory for modern machining, precision automatic machinery turned parts, centreless cylindrical grinding seeks connections with American firm in order to take over manufacture of medium and precision mechanics under license. The factory is equipped with the latest turning automatic machinery, for mass production. Please apply to Feinerei & Schalt-Mechanik, Hamburg-Hausbruch/Germany

### "LATE MODEL MACHINE TOOLS"

- GRINDER, INTERNAL, No. 74 Head Hydraulic, late.
- GRINDERS, CYLINDRICAL, 10" x 18" Norton semi-automatic, plumb est, new 1943.
- GRINDERS, SURFACE, 13" x 60" Model 300 Hanchett vertical spindle, new about 1946.
- AUTOMATIC, 1½"-6 spdl No. 61 New Britain checker, serial 25230
- GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
- SURFACE GRINDER, No. 1½" Abrasive, serial 786, late.
- HAMMER, Chamberburg No. 3G pneumatic, late
- LATHES, ENGINE, 24" x 120" centers Boys & Ermes selective gear head, new 1941.
- LATHES, TURRET, No. 5 Gisholt ram type universal, new 1940
- GRINDER, 4" x 12" Model 4H Landis plain cylindrical, new 1943.
- LATHES, ENGINE, 14" x 6' bed Hendey toolroom, Timken, 1940.
- LATHES, TURRET, No. 3 Gisholt universal (2) late.
- LATHES, TURRET, 36" & 42" Ballard New Era vertical.
- DRILL RADIAL, 5' arm 13" col. Fodick "Econox" hydraulic, serial 12489, new 1943.
- KELLER ENGRAVERS, Model BL 2416 & 3616 (2) equipped with tracers, angle plates and controls.
- AUTOMATICS, 3½" Acme Gridley Model RA6 automatic bar machines (3), new 1942.
- GRINDER, SURFACE, 12" x 60" No. 5 Abrasive horiz. spindle.
- DIEING PRESSES, 50 & 60 ton Henry & Wright, high speed (3) late type.
- MILLING MACHINE, No. 2-24 Cincinnati Simplex production mill, new 1947.

WRITE FOR ILLUSTRATED CATALOG OF 1000 MACHINE TOOLS

## MILES MACHINERY CO.

PHONE SAGINAW PL 2-3105

2045 E. GENESEE AVE. SAGINAW, MICH.

### BUSINESS OPPORTUNITIES

**WELDING & TANK CO.** W. Cen. Fla. Volume \$76,750 . . . 40 yr. landmark Mfr. tanks, stacks, brechings, pipes, etc. Loc. in prosperous industrial & trading city. 1 city block w/13 bldgs. comprises prop. Low price. Illness . . . Tremendous Potential!!! Dept. 8148

**IRON WORKS** So. E. Ga. Top profits. Ideal loc. Large bldg. & land tract. RR Spur . . . Park. fac. All ept. Retiring . . . Underpriced! A-1 bus. oppy. Investigate! Dept. 86196-A

**MACHINE & WELDING SHOP**: No. E. GA. Est 11 yrs. Big profits. Ideal loc. Modrn. bldg. eqpt. & fixt. Low sales price. Illness. Perfect Investment Dept. 8243.

**TANK WORKS**, So. Cen. Calif. Netted \$8,000 in 8 mo. Mfrs. tanks for many top oil cos. Ideal loc. Compl. equip. Priced very low. Dept. #23763

**SALES AND RENTALS**, Cen. Calif. Chain saws, mowers, tractors, etc. Lg land tract w/3 bldgs. Xint profit oppy! Dept. #23878

**AUTO PARTS & MACHINE SHOP** So. E. Penn. Xint income. Ideal loc. Many acts. thruout country. Lg. 3 story bldg and land tract. All ept included. A-1 bus. oppy. Retiring . . . low price! Inquire now! Dept. 42324

**ALUMINUM COMPANY**, E. CEN. MASS. Glass, aluminum & screen cutting, etc. Xint. loc. & good profits. Oppy. for expansion. Owner other interests. Dept. 42329.

**CHAS. FORD & ASSOC. Inc.**  
6425 Hollywood Blvd. Los Angeles, Cal.

\* Are there any machines or equipment you need, or would like to sell? Advertisements in **MACHINERY**'s Classified and Re-Sale Section bring results! Rates are \$12.00 per single-column inch. Send payment with order. **MACHINERY**, 93 Worth Street, New York 13, N.Y.

# APEX TOOLS

## "APEX" HEAVY-DUTY CUTTERS IN STOCK

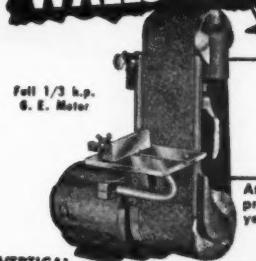
We carry stock cutters for face milling, slotting or straddle milling. Your inquiries invited.



"APEX" manufactures inserted tools and milling cutters of all styles. Carbide-tipped cutters furnished when required.

APEX TOOL & CUTTER CO., Inc., Shelton 11, Conn.

## WALLS TU-WAY BELT SANDER



Full 1/2 h.p.  
C. C. Motor

USE IT EITHER WAY



At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use \$89.95

VERTICAL

Illustrated Literature  
on Request

A few desirable distributor  
territories still available

WALLS SALES CORPORATION

333 Nassau Avenue Brooklyn 22, N. Y.

## MACHINERY'S MATHEMATICAL TABLES

A special book containing 126 pages of the mathematical tables used daily in drafting-rooms and in many shops, including powers and roots of numbers, circumferences and areas of circles, functions of angles, and logarithms. The tables of squares, cubes, square roots, cube roots and reciprocals cover numbers from 1 to 2000. The tables of circumferences and areas are for diameters ranging from 1/64 to 100. The trigonometric functions advance by minutes and degrees and are given to five decimal places. The logarithm tables are also to five decimal places. All of these tables are the same as the ones in MACHINERY'S HANDBOOK, but this small book is especially adapted to continual usage and quick reference. Send your order and \$1.75 to

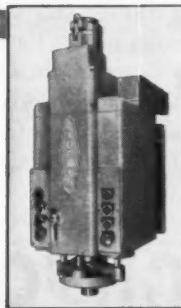
THE INDUSTRIAL PRESS, 93 Worth St., N. Y. 73

For more information fill in page number on Inquiry Card, on page 233

## the all new VERTICAL or HORIZONTAL

### 101 tapper

A brand new . . . Kaufman Tapper with more new operating, control, and production features . . . than has ever before been incorporated into a single tapping head. You can mount it vertically or horizontally . . . arrange it in combinations to do two or more operations . . . or mount it horizontal or angular in combination with vertical heads to do various operations simultaneously. Additional revolutionary features include:



- An extremely sensitive torque control . . . which signals overload, stops the machine automatically to avoid tap breakage.
- A pressure lubricated lead screw.
- Positive precision depth control.
- Air operated clutch with instant reversal.
- A simple non-reversing motor drive.
- Spindle speeds ranging from 35 to 785 RPM.

These and many additional features are incorporated into the new 101 Series Kaufman Tapper. For more complete information about this and other Kaufman Tappers, write

**KAUFMAN MFG. CO.**

549 S. 29th Street Manitowoc, Wisconsin



"My people want to know what  
HELLER TOOL is going to announce  
on Feb. 1!"

**SHOW THIS  
TO YOUR  
TOOLMAKER**

Ask him if he doesn't agree that the Leland-Gifford No. 2LMS Toolroom Drill Press provides every feature and convenience needed in the modern toolroom for fast, accurate, effortless drilling and tapping. Developed in cooperation with leading tool engineers, this machine has won wide acceptance as the ideal drill press for general purpose toolroom use. Write for complete information.

## LELAND-GIFFORD No. 2LMS TOOLROOM DRILL PRESS

*with all these features:*

- 1 Illuminated indicating shift with cutting speed chart.
- 2 Conveniently located hand wheel for changing spindle speeds and shifting back gears without stopping machine.
- 3 Positive stop for accurate depth adjustment.
- 4 Capacity of No. 2 Morse taper. No. 3 MT optional.
- 5 Extra large 37" x 25" or standard 26" x 25" work table.
- 6 26" swing with 13" overhang.
- 7 Handy push-back table raising crank and quick-acting table lock.
- 8 Foot switch start-stop motor control leaves operator's hand free.
- 9 Counterbalanced sliding head for effortless vertical adjustment.
- 10 Built-in light for table and work surface illumination.
- 11 Reversing motor control for tapping — provides manual control from feed lever or automatic control by depth stop.
- 12 Sensitive hand lever feed with ratchet adjustment.



## LELAND-GIFFORD *Drilling Machines*

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 45  
2515 West Peterson Ave.  
DETROIT  
10429 West McNichols Rd.

CLEVELAND 22  
P.O. Box 853

INDIANAPOLIS 6, P. O. Box 1051

NEW YORK OFFICE  
75 South Orange Ave.  
South Orange, N.J.

LOS ANGELES OFFICE  
2620 Leonis Blvd.  
Vernon 58, Cal.

ROCHESTER 12, P. O. Box 24, Charlotte Station

## ALPHABETICAL INDEX OF ADVERTISERS

### A

- Aaron Machinery Co., Inc. .... 298  
 Ace Drill Corp. .... 276  
 Allegheny Ludlum Steel Corp. .... 90  
 Allen-Bradley Co. ....  
     Insert bet. 260-261  
 Allis-Chalmers Manufacturing Co. .... 120  
 American Brass Co. .... 57  
 American Broach & Mch. Co. .... Insert 69-84  
 American Crucible Products Co. .... 266  
 American Schiess Corp. .... 32  
 American Sip Corp. .... 273  
 American Steel Foundries .... 213  
 American Tool Works Co. .... 55  
 Ames, B. C. Co. .... 262  
 Apex Tool & Cutter Co., Inc. 329  
 Armstrong-Blum Mfg. Co. .... 104  
 Armstrong Bros. Tool Co.  
     Front Cover  
 Arter Grinding Machine Co. 300  
 Austin Industrial Corp. .... 45

### B

- Babcock & Wilcox Co. .... 232  
 Baird Machine Co.  
     Inside Back Cover  
 Ball & Roller Bearing Co. .... 327  
 Barnes Drill Co. .... 69-84  
 Barnes, W. F., John Co. .... 69-84  
 Bath, Cyril, Co. .... 106  
 Baush Machine Tool Co. .... 283  
 Bethlehem Steel Co. .... 44, 80  
 Bilgram Gear & Mch. Works 321  
 Blanchard Machine Co. .... 30  
 Bliss, E. W. Co. .... 64-65  
 Brown & Sharpe Mfg. Co. 210-211  
 Bryant Chucking Grinder Co.  
     258-259  
 Buffalo Forge Co. .... 66  
 Bullard Co. .... Insert 34-35

### C

- Chambersburg Eng. Co. .... 108  
 Chicago-Latrobe Twist Drill Works .... 236  
 Chicago Tool & Eng. Co. .... 327  
 Cincinnati Gear Co. .... 273  
 Cincinnati Grinders Inc. .... 6-7  
 Cincinnati Milling Machine Co. .... 16-17  
 Cincinnati Milling Products Div., Cincinnati Milling Machine Co. .... 31  
 Circular Tool Co., Inc. .... 280  
 Cities Service Oil Co. .... 63  
 Classified Advts. .... 328  
 Clausing Div., Atlas Press Co. .... 253

- Clearing Machine Corp., Div.  
     U. S. Industries Inc. .... 111  
 Cleveland Crane & Engrg. Co. .... 112  
 Columbus Die-Tool & Mch. .... 281  
 Cone Automatic Mch. Co., Inc. .... 113  
 Consolidated Mch. Tool Div.  
     Farrel-Birmingham Co., Inc. .... 265  
 Cosa Corp. .... 279  
 Crane Packing Co. .... 271  
 Cross Company .... 118-119  
 Crucible Steel Co. of America .... 85  
 Cumberland Steel Co. .... 92

### D

- Danly Machine Specialties, Inc. .... 121  
 Davis Keyseater Co. .... 281  
 Dearborn Gage Co. .... 227  
 Delta Power Tool Div.  
     Rockwell Mfg. Co. .... 231  
 Denison Engineering Co. .... 102  
 DoAll Company .... 56  
 Dow Chemical Co. .... 261  
 Dreis & Krump Mfg. Co. .... 323  
 duMont Corporation .... 322  
 Dykem Co. .... 326

### E

- Eastern Mch. Screw Corp. .... 310  
 Eisler Engineering Co., Inc. 323  
 Ekstrom-Carlson & Co.  
     Insert 69-84  
 Electro-Spark Co., Inc. .... 296  
 Errington Mechanical Laboratory, Inc. .... 320  
 Etteo Tool Co., Inc. .... 325  
 Ex-Cell-O Corp. .... 217, 245

### G

- Fairfield Manufacturing Co. .... 270  
 Farrel-Birmingham Co., Inc. 263  
 Farval Corp. .... 37  
 Federal Press Co. .... 272  
 Federal Products Corp. .... 4243  
 Fellows Gear Shaper Co. .... 4-5  
 Ferracute Machine Co. .... 288  
 Foote-Burt Company .... 68

- Gear Specialties, Inc. .... 223  
 Giddings & Lewis Machine Tool Co., G & L and  
     Hypro Div. .... 28-29  
 Gisholt Machine Co. .... 24-25  
 Gleason Works .... 51  
 Goddard & Goddard Co. .... 264  
 Gorton, George, Machine Co. 251  
 Goss & DeLeeuw Mch. Co. .... 248  
 Govro-Nelson Co. .... 321  
 Gray, G. A., Co. .... 22-23  
 Graymills Corp. .... 295  
 Greaves Machine Tool Co. .... 246  
 Greenfield Tap & Die Corp.  
     Insert bet. 68-69  
 Green Instrument Co. .... 315  
 Greenlee Bros. & Co.  
     Insert 69-84  
 Grieder Industries, Inc. .... 257

### H

- Hamilton Tool Co. .... 293, 297  
 Hanchett Magna-Lock Corp. 268  
 Hardinge Brothers, Inc. .... 124  
 Heald Machine Co., The  
     Inside Front Cover  
 Heller Tool Co. .... 281, 289, 314,  
     319, 321, 323, 326, 327, 329  
 Hendey Machine Div., Barber-Colman Co.  
     Insert 69-84  
 Hill Acme Co. .... 110  
 Horsburgh & Scott Co. .... 318  
 Horton Chuck Div., Greenfield Tap & Die Corp. .... 68B  
 Hydraulic Press Mfg. Co. .... 117

### I

- Illinois Gear & Machine Co. .... 269  
 Industrial Press .... 310-311

### L

- Laminated Shim Co., Inc. .... 274  
 Landis Machine Co. .... 2-3  
 Landis Tool Co. .... 10-11  
 LeBlond, R. K., Machine Tool Co. .... 254-255  
 Leland-Gifford Co. .... 330  
 Levin, Louis & Son, Inc. .... 327  
 Linde Air Products Co., Div.  
     Union Carbide and Carbon Corp. .... 33  
 Logansport Machine Co., Inc. .... 247  
 Lovejoy Tool Co., Inc. .... 319  
 Lowe Brothers .... 50

### M

- Madison-Kipp Corp. .... 54  
 Marac Machinery Corp. .... 282  
 Materials Section .... 85-92  
 Mattison Machine Works  
     Insert 69-84  
 Metal Carbides Corp. .... 314  
 Michigan Production Engineering Co. .... 292  
 Micromatic Hone Corp. .... 304-305  
 Millholland, W. K., Machinery Co., Inc. .... 290  
 Mitts & Merrill .... 306  
 Modern Industrial Engineering Co. .... 307  
 Modern Machine Tool Co. .... 316  
 Moline Tool Co. .... 286  
 Monarch Machine Tool Co. .... 240-241  
 Motch & Merryweather Mchry. Co. .... 287  
 Mummert-Dixon Co. .... 326

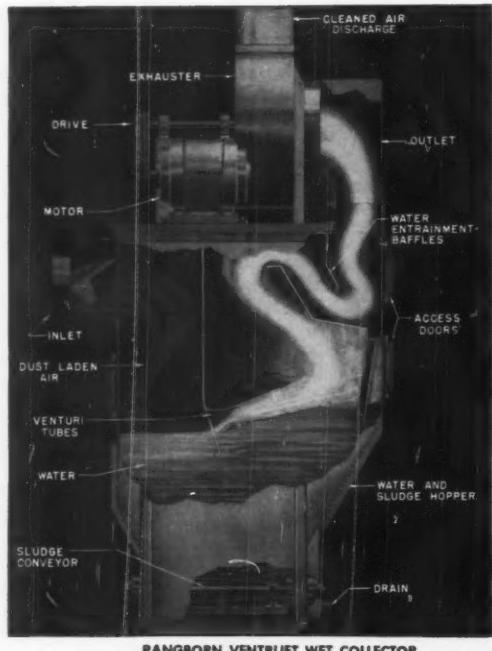
### N

- National Acme Co. .... 239  
 National Automatic Tool Co., Inc. .... 46-47  
 National Broach & Mch. Co. 103  
 National Forge & Ordnance Co. .... 88  
 National Tube Div., United States Steel Corp. .... 115  
 National Twist Drill & Tool Co. .... 41  
 New Britain-Gridley Machine Div., New Britain Machine Co. .... Insert bet. 94-95  
 New Departure, Div.  
     General Motors .... 20  
 New Jersey Gear & Mfg. Co. 323  
 Niagara Machine & Tool Works .... 18-19  
 Nilson, A. H., Machine Co. .... 260  
 Norton Company .... 14-15, 48-49

## ALPHABETICAL INDEX OF ADVERTISERS

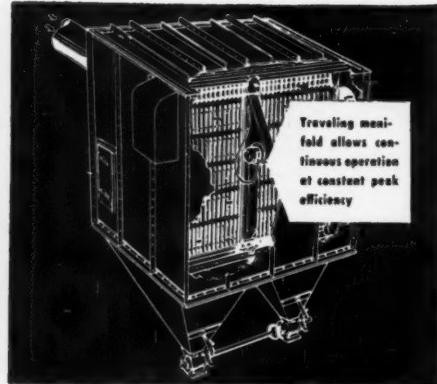
|  |   |   |   |
|--|---|---|---|
| <b>O</b>   | <b>S</b>                                    | <b>T</b>                                      |   |
| Oakite Products, Inc. .... 87                                    | Rockford Machine Tool Co. .... Insert 69-84 | Sundstrand Machine Tool Co. .... Insert 69-84 | Universal Engineering Co. .... 225, 294       |
| Olofsson Corp. .... 237  | Rowbottom Machine Co. .... 319              | Sun-Lite Manufacturing Co. .... 308           | Used Machinery ..... 328                      |
| Orange Roller Bearing Co., Inc. .... 109                         | Russell, Holbrook & Henderson, Inc. .... 59 |   |   |
| Osborn Mfg. Co. .... 116   | Ruthman Machinery Co. .... 316              |   |   |
|  | Ryerson, Joseph T. & Son, Inc. .... 126     |   |   |
|  |   |   | <b>V</b>                                      |
|  |   |   | Van Norman Machine Co. .... 8-9               |
|  |   |   | Vascoloy-Ramet Corp. .... 229                 |
|  |   |   | Verson Allsteel Press Co. .... 100            |
|  |   |   | Vickers, Inc. Div. Sperry Rand Corp. .... 291 |
|  |   |   | Viking Pump Co. .... 313                      |
|  |   |   | Virginia Gear & Machine Co. .... 36           |
|  |   |   |   |
| <b>P</b>   | <b>S</b>                                    | <b>U</b>                                      | <b>W</b>                                      |
| Pangborn Corporation .... 332                                    | Scherr, George, Co., Inc. .... 328          | Timken Roller Bearing Co. .... Back Cover     | Waldes Kohinoor, Inc. .... 250                |
| Parker-Kalon Div., General American Transportation Corp. .... 95 | Scott Paper Co. .... 242                    | Steel & Tube Div. .... 91                     | Wales Stripit Co. .... 219                    |
| Philadelphia Gear Works, Inc. .... 36                            | Seneca Falls Mch. Co. .... 105              | Tomkins-Johnson Co. .... 107                  | Walker, O. S., Co., Inc. .... 278             |
| Pope Machinery Corp. .... 317                                    | Sheffield Corp. .... 275                    | Townsend, H. P. Mfg. Co. .... 302             | Walls Sales Corp. .... 329                    |
| Portage Machine Co. .... 58                                      | Sheldon Machine Co., Inc. .... 299          | Triplex Machine Tool Corp. .... 327           | Warner & Swasey Co. .... 26-27                |
| Pratt & Whitney Co., Inc. 266-267                                | Simonds Abrasive Co. .... 101               |   | Western Machine Tool Works .... 114           |
|  | Simonds Saw & Steel Co. .... 61             |   | Wheelock, Lovejoy & Co. .... 309              |
|  | Snyder Tool & Engrg. Co. .... 22-53         |   | Williams, J. H. & Co. .... 252                |
|  | South Bend Lathe Works .... 249             |   | Winter Bros. Co. .... 40                      |
|  | Spiral Step Tool Co. .... 326               |   |   |
|  | Stahl Gear & Machine Co. .... 321           |   |   |
|  | Standard Electrical Tool Co. .... 301       |   |   |
|  | Standard Gage Co., Inc. .... 67             |   |   |
|  | Standard Oil Co. .... (Indiana) 93-99       |   |   |
|  | Standard Pressed Steel Co. .... 38-39, 96   |   |   |
|  | Starrett, L. S., Co. .... 214               |   |   |
|  | Sun Oil Co. .... Insert bet. 32-33          |   |   |
|  |   |   | <b>Y</b>                                      |
|  |   |   | United States Drill Head Co. .... 62          |
|  |   |   | United States Steel Corp. .... 86, 115        |
|  |   |   | Yoder Co. .... 258                            |

### **NOW—Great news about two new Pangborn Dust Collectors!**



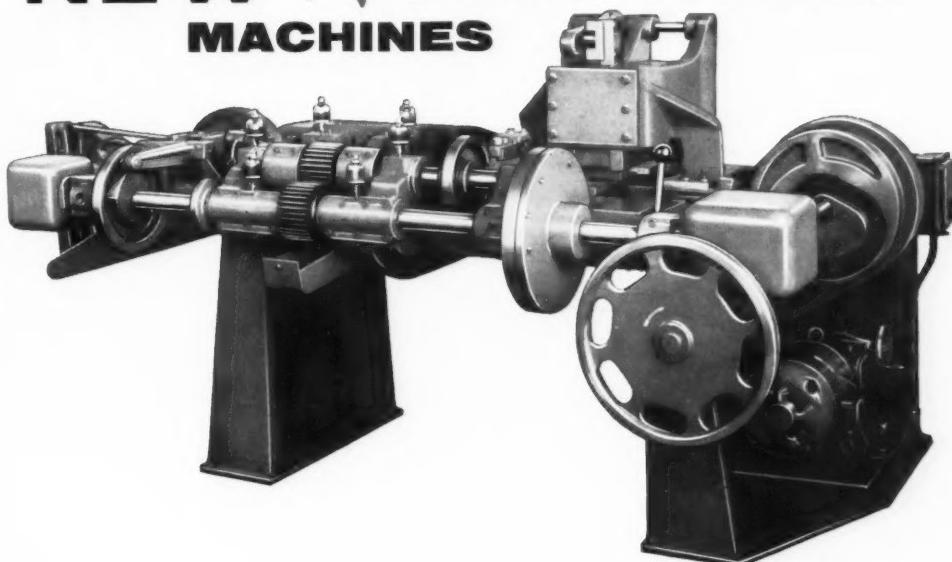
These two new developments in industrial dust control by Pangborn are designed to handle any dust problem! The new Pangborn Self-Cleaning Collector utilizes a traveling reverse air manifold for continuous operation at constant peak efficiency. Use the new Pangborn Ventrijet for effective control of dusts a dry collector cannot handle! For complete information, write to: PANGBORN CORPORATION, 1200 Pangborn Boulevard, Hagerstown, Maryland.

**Pangborn**  
**CONTROLS DUST**



...ask **BAIRD** about it

## NEW *Ribbon Metal* MACHINES



Open **UNEXPLORED** opportunities for cost reduction  
in manufacture of a wide range of parts.

- HIGH SPEED
- UNIFORM PRODUCT
- LOW TOOLING COST
- EASY MAINTENANCE
- SIMPLE OPERATION
- UNLIMITED RANGE

If you are producing small . . . or even quite large . . . formed parts out of ribbon wire or metal strip up to about 2" wide, it will most certainly pay you to "ask Baird about it." More and more quality and cost-conscious manufacturers are finding that our NEW model Automatic High Speed Ribbon Metal Forming Machines are the ideal "production line" for such products.

Behind these machines are years of successful application to a range of work "limited only by the ingenuity of the men who design the tooling." NEW models include a host of important improvements and additional features which greatly extend the range of work and tooling possibilities. For example, what is essentially a substantial press is built right into the machine and is capable of maintaining precision in high-speed production. Baird's unique two-to-one feeding mechanism and EASY cam motions, combined with the fact that 3/4 of the cycle is available for forming rather than the usual 1/2-cycle, permits far greater latitude in combining operations and complexity of possible forms.

Our Engineering Department will be glad to give you further detailed information or to submit recommendations on parts or prints of your product. Write Dept. M.

*Interested in Deferred Payment? . . . "ask Baird about it."*

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL  
FORMING MACHINES • AUTOMATIC FREEZERS • TUMBLING BARRELS

**THE BAIRD MACHINE COMPANY**

STRATFORD

CONNECTICUT

# New design cuts setup time— TIMKEN® bearings up precision

**B**ECAUSE it has no cams to change, this Warner & Swasey 2AC Single Spindle Chucking Automatic sets up fast like a turret lathe, gives you automatic operation without the usual time-consuming setup procedures.

And among the many design features contributing to the lasting production accuracy of the 2AC is the mounting of the spindle on Timken® tapered roller bearings.

Because of their tapered design, Timken bearings take radial and thrust loads in any combination, hold the spindle in rigid alignment.

Full line contact between Timken bearing rollers and races provides maximum load-carrying capacity. And, because Timken bearings are built to last the life of the machine, maintenance costs go down.

Timken bearings also save power because they practically eliminate friction. They are geometrically designed to give true rolling motion, precision manufactured to live up to their design. And to be sure we get steel good enough for Timken bearings, we make our own fine alloy steel. We're America's only bearing manufacturer that does.

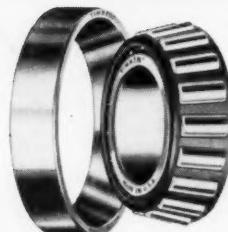
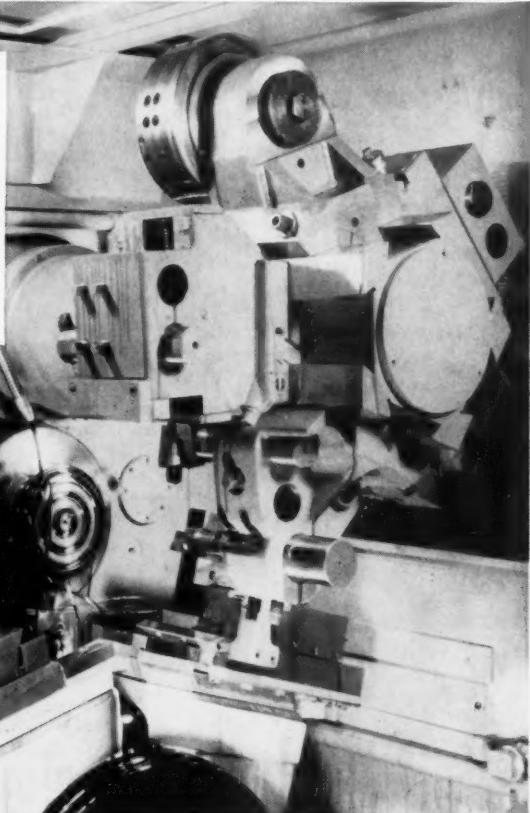
No other bearings give you all the advantages that Timken bearings give you. That's why so many manufacturers of equipment that *must* have dependable bearing performance use them. Whether you buy or build machinery, be sure to specify Timken bearings. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".



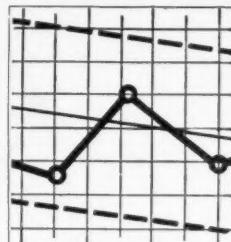
This symbol on a product means its bearings are the best.



**HOW WARNER & SWASEY** mounts the spindle of its 2AC Single Spindle Chucking Automatic on Timken bearings to get maximum rigidity, precision and steady machine operation.



**TIMKEN**  
TRADE-MARK REG. U. S. PAT. OFF.  
**TAPERED ROLLER BEARINGS**



## STATISTICAL QUALITY CONTROL

To insure uniform high quality and closer tolerances, the Timken Company uses statistical quality control. With it, tolerance deviations are plotted graphically. It's one of industry's newest, most scientific methods of improving product uniformity.

NOT JUST A BALL ○ NOT JUST A ROLLER □ THE TIMKEN TAPERED ROLLER □ BEARING TAKES RADIAL ○ AND THRUST —□— LOADS OR ANY COMBINATION □